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THESIS

DESIGN AND IMPLEMENTATION OF A PROTOTYPE
PC BASED GRAPHICAL AND INTERACTIVE
MILSATCOM REQUIREMENTS DATABASE SYSTEM

by

William M. Major

June, 1993

Primary Advisor:

Magdi N. Kamel

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93-28395



93 11 19 035

Unclassified

Security Classification of this page

REPORT DOCUMENTATION PAGE				
1a Report Security Classification: Unclassified			1b Restrictive Markings	
2a Security Classification Authority			3 Distribution/Availability of Report	
2b Declassification/Downgrading Schedule			Approved for public release; distribution is unlimited.	
4 Performing Organization Report Number(s)			5 Monitoring Organization Report Number(s)	
6a Name of Performing Organization Naval Postgraduate School	6b Office Symbol (if applicable) 39	7a Name of Monitoring Organization Naval Postgraduate School		
6c Address (city, state, and ZIP code) Monterey CA 93943-5000		7b Address (city, state, and ZIP code) Monterey CA 93943-5000		
8a Name of Funding Sponsoring Organization U.S. Space Command	6b Office Symbol (if applicable) J-6	9 Procurement Instrument Identification Number N62271RLNTB		
Address (city, state, and ZIP code) Peterson AFB CO 80914		10 Source of Funding Numbers MIPR NS-93-76		
		Program Element No	Project No	Task No
		Work Unit Accession No		
11 Title (include security classification) DESIGN AND IMPLEMENTATION OF A PROTOTYPE PC BASED GRAPHICAL AND INTERACTIVE MILSATCOM REQUIREMENTS DATABASE SYSTEM				
12 Personal Author(s) Major, William M.				
13a Type of Report Master's Thesis	13b Time Covered From To	14 Date of Report (year, month, day) 1993, June	15 Page Count 139	
16 Supplementary Notation The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.				
17 Cosati Codes			18 Subject Terms (continue on reverse if necessary and identify by block number)	
Field	Group	Subgroup	MILSATCOM Requirements Database, MRDB, Databases, Database Design, Microsoft Access	
19 Abstract (continue on reverse if necessary and identify by block number) This thesis develops a prototype PC based Military Satellite Communications (MILSATCOM) Requirements Database (MRDB) application for U.S. Space Command, using Microsoft's Access relational database management system (DBMS) for Windows. It demonstrates the advantages of using the proposed database system over the existing one and shows how U.S. Space Command can save both time and money by using a PC based interactive, graphical, and user friendly database system. A rapid prototyping approach in concert with a six phase database design process was used to develop the prototype. The first two chapters of the thesis provide a background of the application and describe database management systems in general and Microsoft Access in particular. The applications of Access - tables, queries, forms, reports, macros, and modules - to the design of the MRDB are then discussed in the succeeding five chapters. The conclusions describe the advantages and benefits of using the prototype MRDB database system and make recommendations for future improvements.				
20 Distribution/Availability of Abstract <input checked="" type="checkbox"/> unclassified unlimited - <input type="checkbox"/> same as report <input type="checkbox"/> DTIC users			21 Abstract Security Classification Unclassified	
22a Name of Responsible Individual Magdi N. Kamel		22b Telephone (include Area Code) 408-656-2494	22c Office Symbol AS/KA	

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted

security classification of this page

All other editions are obsolete

Unclassified

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Design and Implementation of a Prototype
PC Based Graphical and Interactive
MILSATCOM Requirements Database System

by

William M. Major
Captain, United States Air Force
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Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN SYSTEMS TECHNOLOGY

from the

NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

This thesis develops a prototype PC based Military Satellite Communications (MILSATCOM) Requirements Database (MRDB) application for U.S. Space Command, using Microsoft's Access relational database management system (DBMS) for Windows. It demonstrates the advantages of using the proposed database system over the existing one and shows how U.S. Space Command can save both time and money by using a PC based interactive, graphical, and user friendly database system. A rapid prototyping approach in concert with a six phase database design process was used to develop the prototype. The first two chapters of the thesis provide a background of the application and describe database management systems in general and Microsoft Access in particular. The applications of Access - tables, queries, forms, reports, macros, and modules - to the design of the MRDB are then discussed in the succeeding five chapters. The conclusions describe the advantages and benefits of using the prototype MRDB database system and make recommendations for future improvements.

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DTIC - TAB	E
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Justification	
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Distribution	
Availability Codes	
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DTIC QUALITY INSPECTED 1

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I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to develop a prototype Military Satellite Communications (MILSATCOM) Requirements Database (MRDB) application for U.S. Space Command. Microsoft's Access relational database management system (DBMS) for Windows is the vehicle for this implementation. The requirements are to build an interactive, graphical and user friendly database system that will allow U.S. Space Command to manage the MRDB database "in-house".

B. BACKGROUND

In February of 1992 the Naval Postgraduate School was approached by U.S. Space Command to assist in developing a decision support system for their military satellite communications resources, to be known as the MILSATCOM Decision Support System (MDSS). The purpose of the MDSS is to provide U.S. Space Command with an accurate and cost effective means to manage its communication resources for operational planning and real-time status monitoring. To accomplish this task, the MDSS must be able to store and process current satellite requirements and constraints data, and provide information on individual MILSATCOM satellite constellation capabilities. The proposed MDSS will consist of several

different databases and analysis tools that will be integrated into a single decision support system. One of the databases that will be included in the MDSS is the MRDB database. [Ref. 1:p. 1]

The MRDB is a database that defines and contains all unbiased network requirements, Joint Chiefs of Staff (JCS) validated network requirements, and Commander in Chief (CINC) validated future network requirements for satellite communications. The MRDB is used extensively by U.S. Space Command, Air Force (AF) Space Command, the Joint Staff (JS) and others for MILSATCOM system advocacy, architecture development, operational planning, and requirements maintenance. The MRDB currently contains over 1,500 network requirements and will be an integral part of the MDSS. [Ref. 2]

The MRDB was developed and is currently maintained by ARINC Research Corporation in Colorado Springs, Co. ARINC uses INFORMIX DBMS software to access and manipulate the data in the database. The current system, however, is costly in terms of both time and dollars. For example, when U.S. Space Command wants to retrieve data from the database or run a report, they must first call or submit this request to ARINC. ARINC then performs the retrieval or runs the report and forwards this information back to U.S. Space Command. This process usually takes several days to complete. With today's technology, the obvious question is why can't U.S. Space

Command and others perform this retrieval without the "middle man"? The intent of this thesis is to demonstrate that they can.

C. BENEFITS OF THE STUDY

By showing how U.S. Space Command can save time and money using a PC based interactive, graphical database system to access and manipulate the data in the MRDB database, we will demonstrate how they can manage the MRDB database "in-house" without the assistance of a contractor. This work is part of an overall research effort being conducted by the Naval Postgraduate School professors and students for U.S. Space Command.

D. SCOPE OF THE THESIS

The scope of this thesis is to develop a prototype MRDB database system based upon Microsoft Access for U.S. Space Command. The prototype will allow a functional user to interactively access and manipulate the database with ease and demonstrate the benefits of using Graphical User Interface (GUI) design principles. A dummy database will be created to populate and test the system. This research project is not responsible for determining the data requirements for the database. These requirements are determined by the thesis written by Capt Ron Kearns, USAF. In his thesis the logical

database structure is developed and used in this project for the actual design and development of the database system.

E. METHODOLOGY

The goal of this effort is to develop a workable prototype based on sound database design principles. We adopt a rapid prototyping approach to achieve this design. The prototype database system was developed using a two activity approach, with each activity being the subject of a separate thesis research project. This thesis concentrates on the second activity, the actual design and development of the database system, whereas a parallel thesis by Capt Ron Kearns, USAF, is responsible for the first activity, the development of the logical database structure. This thesis followed a six phase database design process to develop the prototype:

1. Requirements collection and analysis.
2. Conceptual database design.
3. Choice of a DBMS.
4. Logical database design.
5. Physical database design.
6. Database implementation. [Ref. 3:p. 458]

Each of these phases and the methodology used is discussed in more detail in Chapter II, in the Database Design Methodology section.

F. ORGANIZATION OF THE THESIS

This thesis consists of eight chapters supported by several figures and appendices. The structure of the remaining chapters is briefly summarized below.

Chapter II, Introduction to Databases, Database Design Methodology, and Microsoft Access, briefly discusses database management systems in general and Microsoft Access in particular. This chapter also describes the methodology used in each phase of the database design process.

Chapter III, MRDB Application Tables, describes the database schema and includes a description of the 13 tables defined in the database.

Chapter IV, MRDB Application Queries, describes the queries that were predefined and incorporated into the design of the database application. Tables, fields, and conditions used by these queries are also described.

Chapter V, MRDB Application Forms, shows the forms and menus developed for this application, and the interaction of these forms and menus with the menu-driven system.

Chapter VI, MRDB Application Reports, describes the two reports available in the MRDB, the content of each report section, and identifies the report or sub-report that generates the section.

Chapter VII, MRDB Application Macros and Modules, describes the macros and modules used by this application,

including the purpose of each macro and module and the actions performed by them.

Chapter VIII, Conclusions and Recommendations, discusses the advantages and benefits of using the prototype MRDB database system and offers recommendations for future development.

II. INTRODUCTION TO DATABASES, DATABASE DESIGN METHODOLOGY, AND MICROSOFT ACCESS

A. WHAT IS A DATABASE?

A database is simply a collection of records related to each other because of their topic or purpose. For example, military personnel records in a filing cabinet, a collection of telephone numbers in a telephone book, or serial numbers in a card catalog are all examples of databases. [Ref. 4:p. 6]

B. WHAT IS A DATABASE MANAGEMENT SYSTEM?

"A database management system (DBMS) is a system that stores and retrieves information in a database." [Ref. 4:p. 6] It's the filing cabinet that stores personnel records, the telephone book that contains telephone numbers, or the card catalog that contains the serial numbers of books. A computerized DBMS is a database that allows you to store and retrieve this data on your computer. [Ref. 4:p. 6]

C. WHAT IS AN INTERACTIVE AND GRAPHICAL DATABASE SYSTEM?

An interactive database system allows a user to access and update the data in a database in a real-time manner. A graphical database is one that uses visual features such as windows, icons, buttons, scroll bars, etc. to enhance the ease of use of a database system.

D. DATABASE DESIGN METHODOLOGY

The database design process typically consists of two main activities that can be divided into six main phases or steps as illustrated in Figure 1. The first activity, accomplished by Capt Kearns' thesis, involves the development of the logical database structure, whereas the second activity, accomplished by this thesis, is responsible for the actual design and development of the database system. These two activities are usually performed in parallel and are closely intertwined and influenced by one another. The six phases of the database design process are:

1. Requirements collection and analysis.
2. Conceptual database design.
3. Choice of a DBMS.
4. Logical database design.
5. Physical database design.
6. Database implementation. [Ref. 3:p. 458]

The following describes the methodology used in each phase of the database design process during the development of the MRDB database.

1. Phase 1: Requirements Collection and Analysis

Capt Kearns' thesis determined the data requirements whereas we examined and identified the intended uses of the

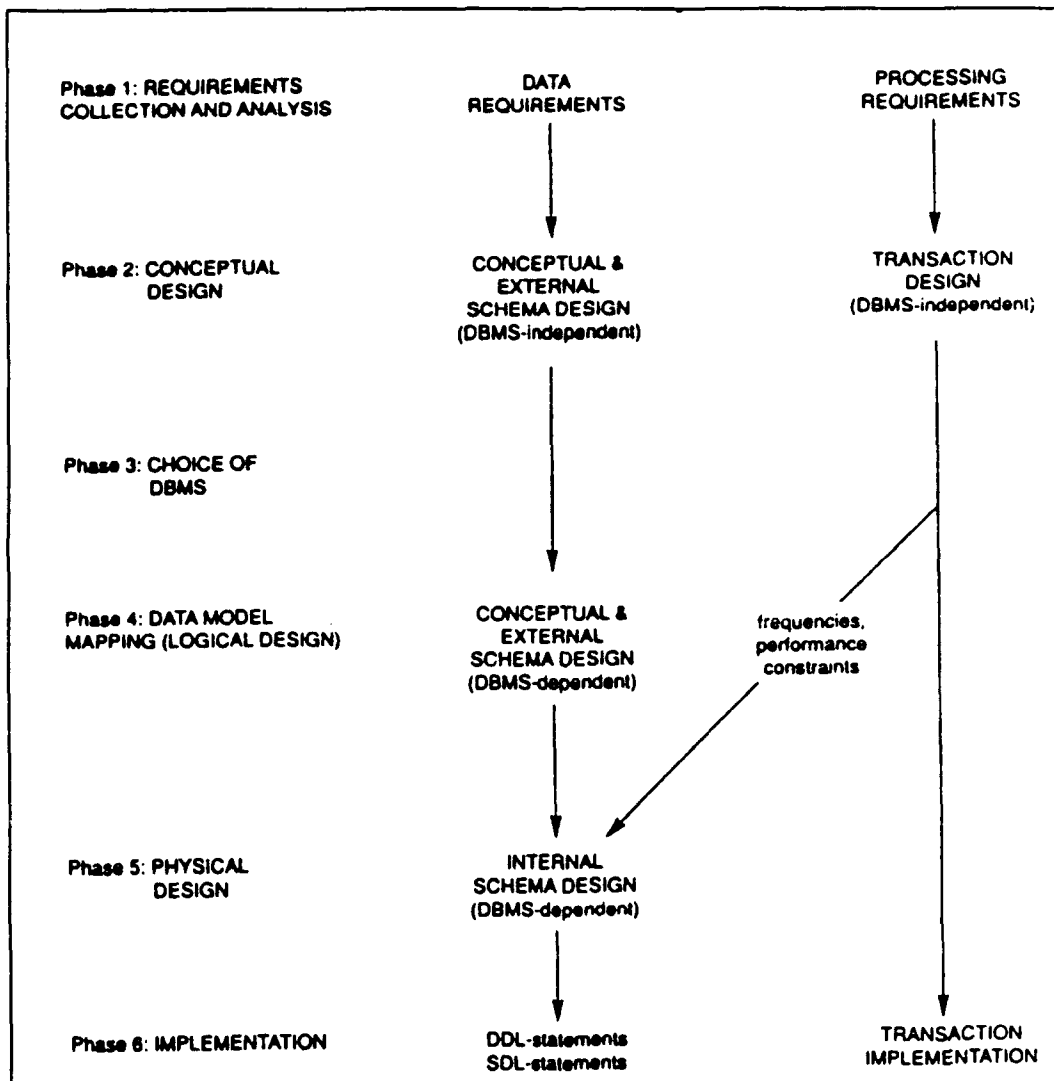


Figure 1 Database Design Process [Ref. 3:p. 459]

database system by first reviewing the existing documentation of the current MRDB database system, and then by interviewing prospective database users at U.S. Space Command and Air Force Space Command.

2. Phase 2: Conceptual Database Design

During the conceptual database design phase, two parallel activities occur - the **conceptual schema design** and the **transaction design**. The goal of the first activity is to transform the data requirements defined in the first phase into a high-level DBMS-independent conceptual database schema. This part of the design process was accomplished in Capt Kearns' thesis. [Ref. 3:p. 461]

The goal of the second activity is to examine the database applications from the first phase and determine which transactions need to be incorporated into the database system. [Ref. 3:p. 461] During this phase the four major transactions were detailed by prospective users. They were (1) the ability to view, edit, and add the pertinent records to the database, (2) the ability to delete records from the database, (3) the ability to query the database, and (4) the ability to produce reports from the database. Each of these transactions was further divided into sub-transactions. A complete discussion of these transactions is presented in Chapter V.

3. Phase 3: Choice of a DBMS

The next phase in the database design process is to select a database management system that is suitable for the task at hand. Factors to consider include technical and performance characteristics, the structure of the database, and the cost. [Ref. 3:p. 470] This project required a DBMS that is PC based, relational, graphical, and has powerful application development tools. Microsoft Access was selected because it satisfied all of these requirements by combining the powerful capabilities of a relational DBMS with the graphical features available in Microsoft Windows.

4. Phase 4: Logical Database Design Phase

The purpose of this phase is to transform "the conceptual schema from the high-level data model used in phase 2 into the data model of the DBMS chosen in phase 3." [Ref. 3:p. 459] This part of the process was accomplished by Capt Ron Kearns who converted the high-level entity-relationship model from the second phase into a relational database model (schema). This thesis then used the relational database model to identify the tables for the MRDB database.

5. Phase 5: Physical Database Design

The next step is the physical database design phase. The purpose of this phase is to "specify the internal storage structures and file organizations for the database." [Ref. 3:p. 39] During this phase of the thesis the data fields, the

primary and foreign keys, and the relationships between the MRDB tables identified in the fourth phase were defined.

6. Phase 6: Database System Implementation

The bulk of this thesis was to actually create and implement the database system. [Ref. 3:p. 474] This was first done by creating the tables for the database system and populating them with data. The next step was creating the queries, forms, and reports for the database system and integrating them together using macros into a customized application. The last step was testing the database system and demonstrating the final design to the users at U.S. Space Command.

E. WHAT IS MICROSOFT ACCESS?

Microsoft Access is a computerized database management system (DBMS) used in conjunction with the Microsoft Windows operating environment. It puts the power to organize, locate, and present information in the hands of the user, and takes full advantage of the graphical power available in Windows, giving the user a visual means to access and manipulate the data in a database. Using Microsoft Access, one can easily store information pertaining to different subjects in a database, yet relate them to each other in a dynamic fashion through relationships. [Ref. 4:pp. 1-6]

Microsoft Access consists of six main parts that allow a user to define the way they want to store, locate, retrieve, and view the data in their database. The six parts are tables, queries, forms, reports, macros and modules. Each of these parts is briefly described below and is detailed in the succeeding chapters. [Ref. 4:pp 8-13]

1. Tables

A table is the most basic element of a database system because it defines where and how the data is stored in a database. Tables define the records and their associated data fields that make up a database. A data field is the smallest unit of information that describes something, such as a network ID or acronym. A record is a collection of these data fields, such as a network requirement record, that defines a particular subject or thing. A table is a collection of these related records. Refer to Chapter III for more information on tables or see Appendix A for an example of a table. [Ref. 4:p. 8]

2. Queries and Dynasets

A query is what makes a database such a powerful tool because it allows a user to ask a question about the data stored in the tables. For example, someone might want to know all network requirements that require anti-jamming. The data that answers that question can come from one or more tables. A dynaset is a dynamic set of records that represents the

answer to a query. It is called a dynaset because the data of the query will be the most current in the database. A person can use a dynaset much like a table, however the main distinction between the two is that the data is actually stored in tables and not in queries and dynasets. [Ref. 4:p. 9]

3. Forms

A form is a predefined, custom layout used to enhance and increase the efficiency of a database system. A form can be created to view or enter data in a certain way or it can be created as a menu. A menu offers the user several different options to be executed on one form. The user selects the option (s)he wants by clicking the appropriate button or marking the appropriate box. The advantages of using forms is that they greatly increase the readability of the database by allowing a user to specify the unique way (s)he wants to see their data. [Ref. 4:p. 10]

4. Reports

A report is a meaningful and effective way to present data in a printed document. Like a form, a report can be organized and formatted to a user's specifications. A report can be previewed on a user's terminal screen or it can be directed to a printer for hard copy printout. [Ref. 5:p. 396]

5. Macros

"A macro is a list of actions you want Microsoft Access to carry out for you." [Ref. 4:p. 12] Macros can be used to automate routine or repetitive tasks or to integrate a set of menus, forms, queries, and reports to work together intelligently in a menu-driven system. [Ref. 4:pp. 505-507]

6. Modules

A module is a collection of one or more procedures written in Access Basic that are too complicated or complex for a macro to handle. Procedures are written in Access Basic, the built-in database programming language provided in Access. [Ref. 4:p. 13]

The MRDB database system developed for this thesis uses these six components for its implementation. The table definition facility is used to define the tables that constitute the MRDB database. The query facility is used to define the most commonly requested queries. The form facility is used to provide the user with a convenient way to enter, change, and view the records in the database. The report facility is used to produce the most commonly requested reports. Finally, macros and procedures are created to integrate the queries, forms, and reports into a customized menu-driven system. The application of each of these components will be explained in the succeeding chapters.

III. MRDB APPLICATION TABLES

A. DATABASE SCHEMA

The database design process normally consists of two parallel activities that are divided into six main phases. One of the goals of the first activity is to produce a high-level DBMS dependent database schema [Ref. 3:p. 472] - in this case a relational database schema. This is accomplished during the logical database design phase (phase 4) of the database design process. During this phase the high-level conceptual schema produced in phase 2 is transformed into the data model of the DBMS chosen in phase 3. [Ref. 3:p. 459] The result of this phase is a database schema in the data model of the chosen DBMS. [Ref. 3:p. 39] The database schema produced during phase 4 for this project is shown in Figure 2 [Ref. 6:p. 60]. This model was developed by Capt Kearns for his thesis and is used here to accomplish phases 5 and 6. Since the DBMS selected for this project is relational, the DBMS dependent data model shown in Figure 2 is called the MRDB relational model (schema). This model identifies the tables of the MRDB database and shows the relationships between them. Once these tables are identified, one can proceed with the physical design phase of the database.

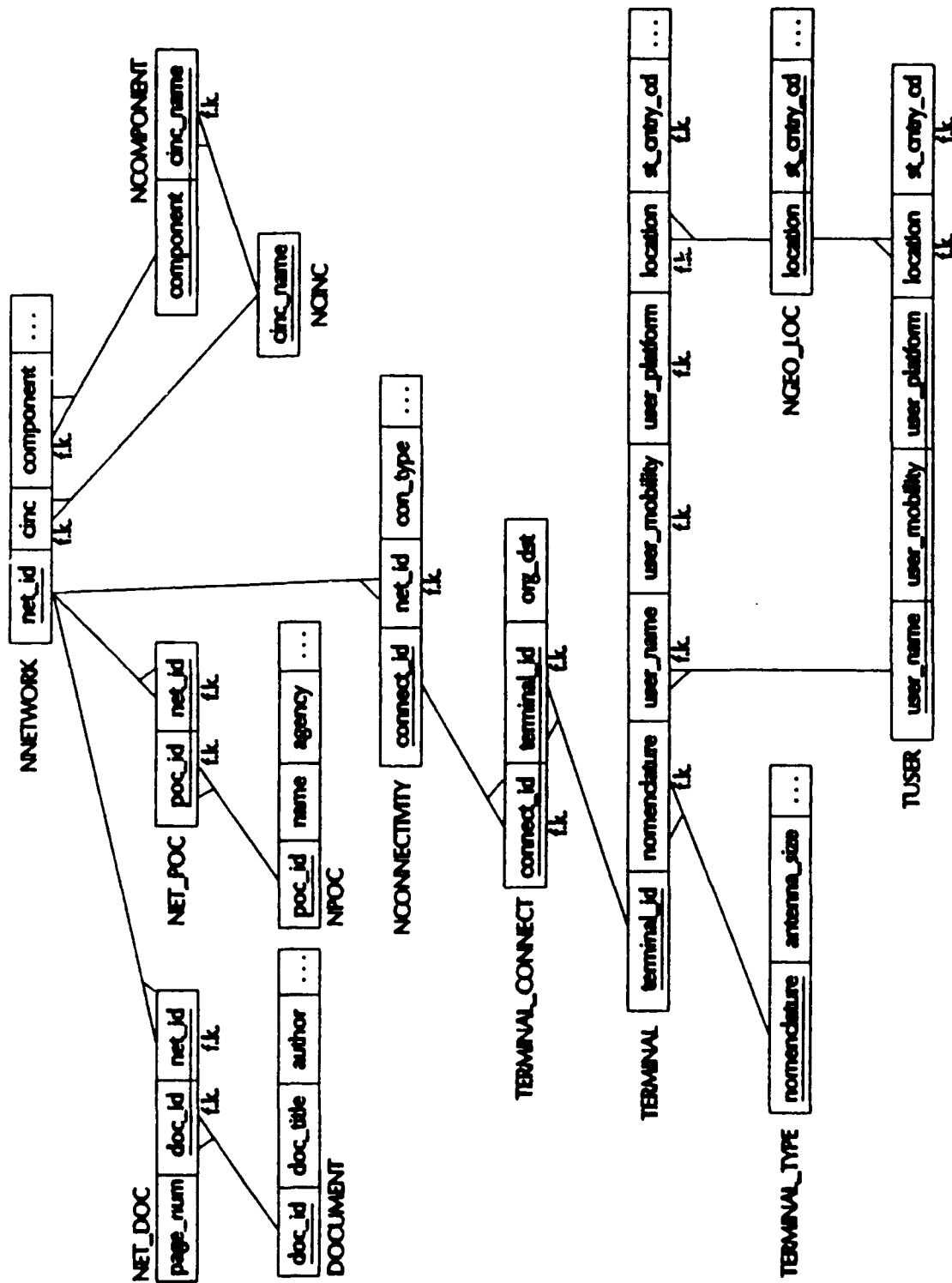


Figure 2 MRDB Relational Model [Ref. 6:p. 60]

The MRDB relational model shown in Figure 2 shows that the database is centered around the **network** table. The network table defines a network requirement for a **CINC** and its **component**. Each network consists of one-to-many **connectivities**. Connectivities are connections between two **terminals** and their **users** located throughout the world. These locations are defined in the **geo-location** table. Each terminal has a unique set of characteristics specified in the **terminal type** table. In addition, networks can have one-to-many **points of contact (POC)** who are responsible for the network requirement, and each network can **reference** one-to-many **documents**. For a complete description of this database schema, please refer to the thesis written by Capt Kearns.

B. TABLES

The first step in the physical database design phase (phase 5) is defining the tables for the MRDB database. The database schema produced during the logical database design phase identified 13 tables to be included in the database. Each of these tables is briefly described below. For a complete definition of these tables, please see Appendix A.

1. Network Table

The network table is the largest and most important table in the database. All other tables either further define or provide additional information regarding a network requirement. The network table defines a requirement for a

communication network that will satisfy the communication needs for a particular CINC. It is identified by a network-ID and includes basic information regarding the requirement such as the network name, the primary and secondary missions of the network, the mission definition of the network, the priorities of the network, and the general capabilities and specifications the network should have. A network usually has several connectivities, is associated with a CINC, has several POCs and several documents.

2. Connectivity Table

The second most important table in the database is the connectivity table. The connectivity table describes the unique connectivities that make up a network. A connectivity is any connection between two terminals that provide some type of communication capability to a user. For every unique connectivity there is a unique connectivity record. A network requirement usually necessitates several connectivities in order to satisfy the requirement. In the current MRDB there are over 10,000 connectivities defined, each one belonging to a particular network. The connectivity table is identified by a connectivity-ID and includes basic information regarding a connection such as the connectivity type, the connectivity data type, the operation mode, and the stress and unstressed throughput and data rates of a connection. A connectivity

usually consists of two terminals - the originating terminal and the destination terminal.

3. Terminal Table

Whereas the connectivity table describes the unique connections that make up a network, the terminal table defines the unique terminals that make up these connections. The terminal table is identified by a terminal-ID and includes the geo-location of the terminal, the terminal nomenclature, the reporting designator, the serial number, the activation and deactivation dates, and remarks. Each terminal has a unique terminal type, location, and user associated with it, but a terminal can belong to several connectivities.

4. Terminal-Connect Table

Since a terminal at a particular location can be used by many different connections and a connection can have more than one terminal (maximum of two), the purpose of this intersection table is to specify which terminals (defined in the terminal table) belong to which connectivities (specified in the connectivity table). This table is identified by a connectivity-ID and a terminal-ID and specifies if the terminal of a particular connection is the originating or the destination terminal of a connection.

5. Terminal Type Table

The terminal type table defines the detailed characteristics of the terminals specified in the terminal

table. The table is identified by the terminal nomenclature and includes information such as the frequency and mobility of these terminals, their platforms, the antenna size, and their minimum and maximum data rates. A terminal type can be specified by one or more terminals.

6. User Table

The user table describes the users of the terminals defined in the terminal table and defines the name and geo-location of these users. The table is identified by a user-ID. A user can be associated with one-to-many terminals.

7. Geo-Location Table

The purpose of the geo-location table is to give a complete description of the locations defined in the terminal and user tables. The geo-location table is identified by a geo-location-code and includes information regarding a location such as the full location name, the state-country code, the area code, and the lat and long information of a location. This table is a standard reference file maintained by the Department of Defense and as such is not accessible for update by the user through the application system.

8. POC Table

The POC table defines the points of contact responsible for network requirements. The POC table is identified by a POC-ID and includes vital information regarding the points of contact such as a person's name,

address, and telephone numbers. A point of contact can be responsible for one-to-many networks.

9. Network-POC Table

Since one POC can be responsible for several network requirements and a network requirement can have more than one POC, the purpose of the Network-POC intersection table is to link a POC to a network requirement. This table is identified by a network-ID and a POC-ID and includes no other additional attributes.

10. Document Table

The document table describes the documents referenced by network requirements. The document table is identified by a document-ID and includes the title, author, publication date, and classification of the documents. A document can be referenced by many different networks.

11. Network-Ref-Document Table

Since a document can be referenced by many networks and a document can refer to several networks, the purpose of the network-ref-document intersection table is to identify which documents are referenced by each one of the networks. In addition to establishing the linkage between the network table and the document table, the network-ref-document table also includes the page numbers of the document that is referenced by a particular network. This intersection table is identified by a document-ID and a network-ID.

12. CINC Table

The CINC table consists of the CINC name and is used to provide the linkage between the network table and the CINC component table. The CINC table is identified by a CINC-name and can be referenced by many different networks.

13. Component Table

The component table specifies the valid component names that belong to a CINC. This table is primarily used for validation purposes to ensure that a valid component is entered in the network table when specifying a CINC's component. This table is identified by a component-name and includes the CINC name for each component. A component can be referenced by many different networks and belongs to only one CINC.

Once these tables are defined, we can now begin the development of the queries, forms, reports, macros, and modules for the application. The next chapter describes the queries that were developed for the MRDB database system.

IV. MRDB APPLICATION QUERIES

In Microsoft Access a query can be designed to retrieve certain records from a database or to select certain fields from a table [Ref. 5:p. 93]. The answer to a query is called a dynaset [Ref. 4:p. 9]. "A dynaset is a dynamic set of records that contains data drawn from one or more tables." [Ref. 4:p.9] In Access you can query the database for just about anything using the graphical Query by Example feature which allows a user to compose ad-hoc queries of arbitrary complexity by specifying the tables, data fields, and criteria of a query [Ref. 5:pp. 95-96]. Incorporated into the design of this application are three of the more common queries requested by U.S. Space Command. The three queries are (1) networks by operational dates, (2) networks by CINCs and their components, and (3) networks limited by requirements (such as satisfaction level, anti-jam criteria, access criteria, etc). A user can select the query (s)he wants from a menu and specify its parameters. (The menus that make up the query portion of the database are discussed in more detail in Chapter V. Please refer to that chapter for the actual displays that generate these queries). In addition to the three predefined queries, there are 31 additional queries used to generate reports, provide information for combo boxes

(i.e., look up tables), and display information related to particular records. See Appendix B for a complete listing of all the queries used by this database. The following sections briefly describe the three predefined queries available to a user.

A. NETWORKS BY OPERATIONAL DATES

The query, networks by operational dates, queries the database for all network requirements that fall within the beginning and ending operational dates as specified by the user. The query accesses only one table, the network table, to generate this information. The query returns all network requirements that fall within the specified range and displays them in ascending order by network acronym. The data fields displayed for each network requirement selected are network acronym, network name, network-ID, requirement begin date, and the requirement end date.

B. NETWORKS BY CINCS AND THEIR COMPONENTS

The query, networks by CINCs and their components, queries the network table for all network requirements that match the CINC and component name specified by a user. This query is actually performed by one of three sub-queries depending upon what information is specified by the user. If a user specifies both a CINC and a component name, then the sub-query, networks by CINC and component, is generated. If a

user specifies only a CINC, then the sub-query, networks by CINC name only, is generated. If a user doesn't specify either a CINC or a component name (i.e., the user leaves the input fields blank), then the sub-query, all networks listed by CINC and component, is generated. The data fields displayed for each sub-query are CINC, component, network acronym, network-ID, and network name. The three sub-queries are discussed below.

1. Networks by CINC and Component

This sub-query will search and display all network requirements that match both the CINC and the component name as specified by the user.

2. Networks by CINC Name Only

This sub-query will search and display all network requirements that match the CINC's name. All the components of the specified CINC are displayed.

3. All Networks listed by CINC and Component

This sub-query will display all network requirements in ascending order by CINC and within each CINC in ascending order by component.

C. NETWORKS LIMITED BY REQUIREMENTS

The query, networks limited by requirements, queries the network table for all networks requirements that match the criteria specified by a user. The user can limit the search according to the following criteria.

- Satisfaction level
- Network excluded
- Network critical
- Anti-jamming (AJ) required
- Anti-jamming critical
- Low probability of intercept (LPI) required
- Low probability of intercept critical
- Nuclear scintillation protection (NSP) required
- Electromagnetic pulse protection (EMP) critical
- Anti-spoof critical
- Access critical

The user can specify criteria for all, some, or none of these attributes. This query is actually performed by one of two sub-queries depending on whether a satisfaction level is specified or not. If a user specifies a satisfaction level, then the sub-query, networks by satisfaction level, is generated. However if a user does not specify a satisfaction level (i.e., the user leaves the field blank), then the sub-query, networks by all satisfaction levels, is generated. The data fields displayed for each sub-query are network acronym, network name, and network-ID. The two sub-queries are discussed below.

1. Networks by Satisfaction Level

This sub-query is generated if a satisfaction level is specified by a user. The sub-query will display all network requirements that match the satisfaction level specified as well as any other restrictions that might be specified. This sub-query accesses the network table to provide this

information and displays the network requirements in ascending order based on the network acronym.

2. Networks by All Satisfaction Levels

This sub-query is generated if a satisfaction level is not specified by a user. The sub-query will display all network requirements that match the restrictions specified by the user for all satisfaction levels. This sub-query accesses the network table to provide this information and displays the network requirements in ascending order based on the network acronym.

Whereas this chapter described the queries in the MRDB database system, the next chapter describes the forms that have been developed for the database system.

V. MRDB APPLICATION FORMS

Forms are predefined, customized layouts that allow a user to create, modify, or display data in a database. Forms can also be used to create menus for a menu-driven database system. By creating a menu-driven database system, custom applications can be built that allow a user to navigate relatively easily through the database without having to know much about the database management software or the structure of the database. The database system developed for this thesis is menu-driven and consists of several menus and forms that have been integrated to make a user friendly system. Figure 3 shows the menu hierarchy. The following sections discuss each of these forms in detail and show an example of each one on the corresponding pages.

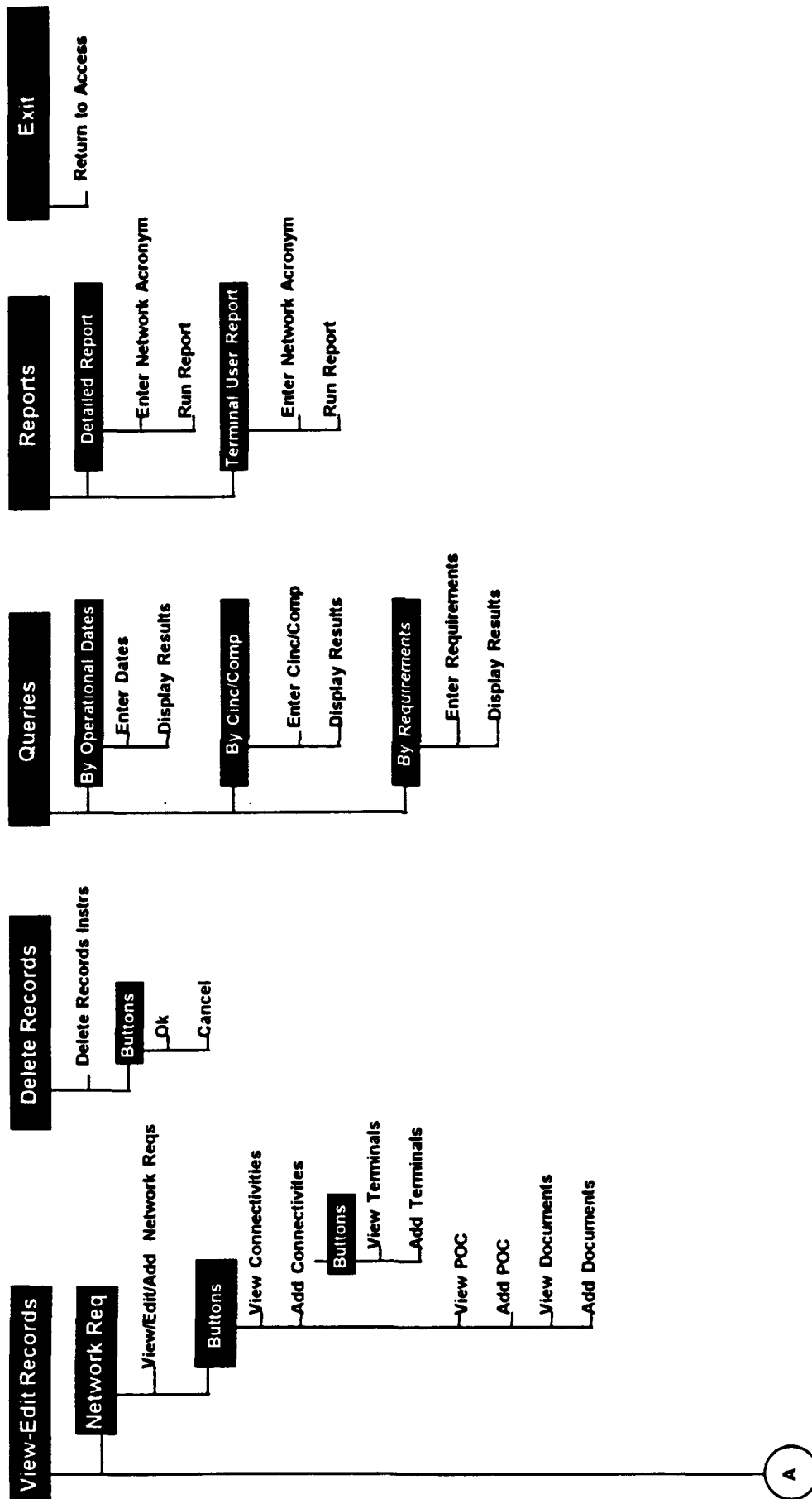


Figure 3 Menu Hierarchy

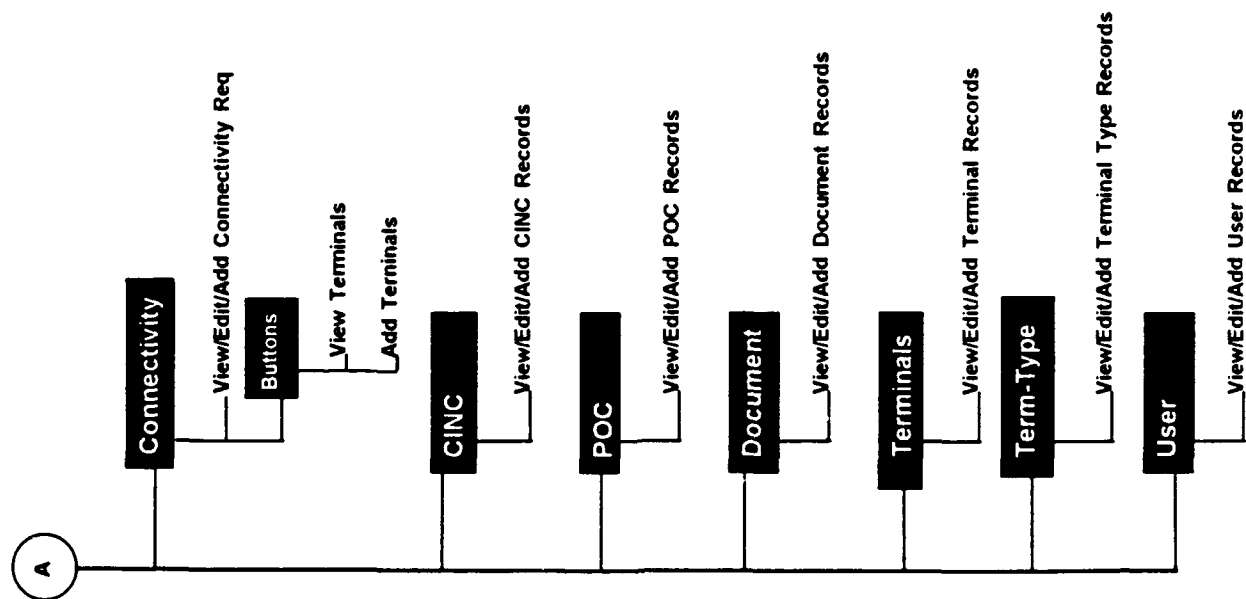


Figure 3 (cont) Menu Hierarchy

A. MAIN-DRIVER MENU

The Main-Driver menu shown in Figure 4 is the first form that appears when a user invokes the MRDB database application. The Main-Driver menu displays the five major actions that a user can perform on the database. The five actions are (1) view/edit records, (2) delete records, (3) query data, (4) generate reports, or (5) exit the database system. A user selects these actions by pointing and clicking the appropriate button on the menu. Each of these selections and the actions performed by them are briefly described below.

1. View-Edit Button

Clicking this button causes the View-Edit-Selection menu to appear. This menu allows the user to view, edit, or add a new network requirement, connectivity, CINC, POC, document, terminal, terminal type or user to the database.

2. Delete Button

Clicking this button causes the Delete-Dialog form to appear. The Delete-Dialog form gives instructions on how to delete a network requirement, connectivity, CINC, POC, document, terminal, terminal type or user from the database.

3. Queries Button

Clicking this button causes the Query-Selection form to appear. This form allows a user to invoke any of the predefined queries. The three choices available are networks

Microsoft Access [Form: Main Driver Menu]

File Edit View Records Window Help

Filter/Sort: Field: CHANGE Records Butto

WELCOME TO THE MILSATCOM
REQUIREMENTS DATABASE

Please select one of the following options

VIEW-EDIT RECORDS

DELETE RECORDS

QUERIES

REPORTS

EXIT

Record: 1

Form View NUM

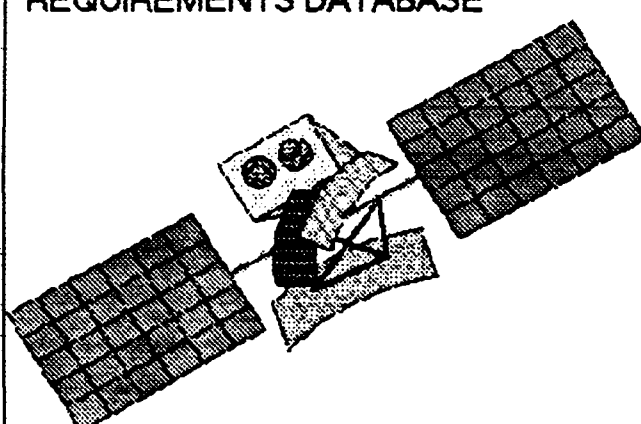


Figure 4 Main Driver Menu

by operational dates, networks by CINC and components, and networks limited by requirements.

4. Reports Button

Clicking this button causes the Report-Selection form to appear. This form allows a user to preview or print the Detailed report or the Terminal User Report.

5. Exit Button

Clicking this button causes the user to exit the database system and return to the application that invoked this application.

B. VIEW-EDIT-SELECTION MENU

The View-Edit-Selection menu shown in Figure 5 displays the tables that can be viewed, edited, or added in the database. A user selects one of these tables by clicking the appropriate button on the menu or selects the "Return" button. Each of these selections and the actions performed by them are described below.

1. View Network Button

Clicking this button causes the Network-Update form to appear. This form allows a user to view, edit, or add a new record to the Network table.

2. View CINC Button

Clicking this button causes the CINC-Update form to appear. This form allows a user to view, edit, or add a new record to the CINC table.

3. View POC Button

Clicking this button causes the POC-Update form to appear. This form allows a user to view, edit, or add a new record to the POC table.

4. View DOC Button

Clicking this button causes the Document-Update form to appear. This form allows a user to view, edit, or add a new record to the Document table.

Microsoft Access [Form: View Edit Selection Menu]

File Edit View Records Window Help

Filter/Sort: Field: All Recs Of A Network

WELCOME TO THE VIEW-EDIT MENU

Please select one of the following options:

VIEW NETWORK REQ	VIEW CONNECTIVITY REQ
VIEW CINC	VIEW TERM
VIEW POC	VIEW T-TYPE
VIEW DOC	VIEW USER

Press Here to Return to Main Menu

RETURN

Record: 1

Form View

NUM

Figure 5 View-Edit-Selection Menu

5. View Connectivity Requirement Button

Clicking this button causes the Connectivity-Update form to appear. This form allows a user to view, edit, or add a new record to the Connectivity table.

6. View Terminal Button

Clicking this button causes the Terminal-Update form to appear. This form allows a user to view, edit, or add a new record to the Terminal table.

7. View Terminal-Type Button

Clicking this button causes the Terminal-Type-Update form to appear. This form allows a user to view, edit, or add a new record to the Terminal-Type table.

8. View User Button

Clicking this button causes the User-Update form to appear. This form allows a user to view, edit, or add a new record to the User table.

9. Return Button

Clicking this button causes the View-Edit-Selection menu to disappear and returns the user to the Main-Driver menu.

C. NETWORK-UPDATE FORM

The Network-Update form shown in Figure 6 allows a user to view, update, and/or add a network requirement to the database. The form consists of three pages of data. A user can move from one page to another by pressing the "Page Down" or the "Page Up" button located on the keyboard. The form also consists of six action buttons on the top of the form and a "Return to Menu" button on the bottom. The "Return to Menu" button is used to return to the View-Edit-Selection menu when the user is finished with the Network-Update form. The actions of the six other buttons are described in the succeeding pages.

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Filter/Sort: Field: Network Acronym

Network Specifications

Net-ID: 1 View Conn View POC View Doc
 Last Update: 5/22/93 Add Conn Add POC Add Doc

Network Acronym: 1 Security Classification: Unclassified (Page 1 of 3)

Network Name: AFSCN Primary Communications Net

Mission Definition: Provides TT&C for FLTSAT, GPS, DSP, DMSP, NATO III, etc

CINC: DCNSPCE CINC Component name: AFSPC

CINC Priority: 1 Global Priority: 1

Reqst Type thresh: Full Period Reqst Type obj: Full Period

Reqst begin date: 12/31/1986 Reqst end date: 12/31/1997

Reqst Type critical (Y/N)? Y Reqst Duration: 5

ISDB Status: JCS Validated Satisfaction: P

Primary System: DSCS Secondary System: Commercial

Network excluded (Y/N)? N Network Critical (Y/N)? Y

Primary mission: 1 Secondary mission: 2 Tertiary mission: 3

Record: 1 Return to Menu

Calculating... NUM

Figure 6 (Page 1 of 3) Network-Update Form

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Filter/Sort: Field: AJ required

Network Specifications

Net-ID: 1 View Conn View POC View Doc
 Last Update: 5/22/93 Add Conn Add POC Add Doc

Anti-jam required (Y/N)? Y Anti-jam critical (Y/N)? Y (Page 2 of 3)

AJ level thresh: 1 AJ level obj: 1

AJ dist thresh: 1 AJ dist obj: 1

LPI required (Y/N)? N LPI critical (Y/N)? N

LPI dist thresh: 1 LPI dist obj: 1

EMP critical (Y/N)? Y NSP required (Y/N)? N

EMP thresh: EMP obj: 0

Masout thresh: 0 Masout obj: 0

Min avail thresh: 20.00% Min avail obj: 25.00%

Avg-calls-per-hour: 1.00 Avg-length-of-call: 1

Duty cycle critical (Y/N)? Y Duty cycle obj: 1

Bit Error Rate critical (Y/N)? Y Duty cycle thresh: 1

Bit Error Rate (ex 5.0): 5 BER exponent obj: 0 thresh: 0

Record: 1 Return to Menu

Network require anti-jam protection? NUM

Figure 6 (Page 2 of 3) Network-Update Form

Microsoft Access [Network Specifications]

File Edit View Records Window Help

Filter/Sort: Conflict_1

Network Specifications

Net-ID: 1
Last Update: 5/22/93

View Cons View POC View Doc
Add Cons Add POC Add Doc

(Page 3 of 3)

Conflict levels - 1: ☒ 2: ☐ 3: ☐ 4: ☐ 5: ☐ 6: ☐ 7: ☐ 8: ☐

Scenario - 1: ☐ 2: ☐ 3: ☐ 4: ☐ 5: ☐ 6: ☐ 7: ☐ 8: ☐

Max message transmit time critical (Y/N)? ☒ Max message transmit time thrsh (secs): 1
Max message transmit time obj (secs): 1

Max allowable access time critical (Y/N)? ☒ Max allowable access time thrsh (secs): 1
Max allowable access time obj (secs): 1

Anti-spoof critical (Y/N)? ☒ Global Reach/Global Power Mission (1-7): 1

Mission Essential (1-3): 1 U. S. Control (Y/N)? ☒

Availability critical (Y/N)? ☒ Command abbr: SP

MILSTAR loaded (Y/N)? ☒

Return to Menu

Record 1

Peace-Does not need to be operational? NUM

Figure 6 (Page 3 of 3) Network-Update Form

1. View Connectivities Button

Clicking this button causes the Network-View-Connectivity form to appear in conjunction with the Network-Update form. These forms are shown in Figure 7. The Network-View-Connectivity form displays the connectivities that belong to the network requirement currently shown on the Network-Update form.

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Field: Button200

Network Specifications

Net-ID: 1
Last Update: 5/18/93

[View Conn](#) [View POC](#) [View Doc](#)
[Add Conn](#) [Add POC](#) [Add Doc](#)

Network Acronym: AFSCN Security Classification: Unclassified (Page 1 of 3)
 Network Name: AFSCN Primary Communications Netu
 Mission Definition: Provides TT&C for FLTSAT, GPS, DSP, DMSP, NATO III ar

View Conn

Record ID	Net-ID	System	Data	FDUX	HDUX	Record ID
1	PT-PT	Data	FDUX			1
2	PT-PT	Data	FDUX			1
6	PT-PT	Video	HDUX			1

Record 1

Primary System: DSCS Secondary System: Commercial
 Network excluded (Y/N)? N Network Critical (Y/N)? Y
 Primary mission: 1 Secondary mission: 2 Tertiary mission: 3

[Return to Menu](#)

Uniquely identifies a connectivity. This field is populated by the MRDB and is inv FLTR NUM

Figure 7 Network-View-Connectivity Form

2. Add Connectivity Button

Clicking this button causes the Network-Add-Connectivity form to appear in conjunction with the Network-Update form. These forms are shown in Figure 8. The Network-Add-Connectivity form allows a user to add a connection to the current network requirement shown on the Network-Update form. The form consists of the data fields that define a connectivity, two action buttons, and a "Return" button. Clicking the "Return" button causes the user to return to the Network-Update form. The actions of the other two buttons are described in the succeeding pages.

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Filter/Sort Field: Button191

Network Specifications

Net-ID: 1
Last Update: 5/18/93

View Conn View POC View Doc
Add Conn Add POC Add Doc

Add Connectivities

Connectivity Specifications

Net-ID: 1
AFSCN: 2

View Term
Add Term

Connectivity Type	RTT 2	Data Type	Data 2
Flow Control	FDUX 2	Number of users	
Priority of traffic (0-255)	N	Source or network ID (0-255)	N
SPB Number		Destination ID Number	
Source address priority		System name	
Unbuffered data rate (kb)	0	Unbuffered data rate (kb)	0
Unbuffered data rate (mb)	0	Unbuffered data rate (mb)	0
Unbuffered data rate (gb)	0	Unbuffered data rate (gb)	0
Unbuffered data rate (tb)	0	Unbuffered data rate (tb)	0

Select connectivity to find: 2

Return

Record 1

Record 1

Type of connectivity or configuration supported

NUM

Figure 8 Network-Add-Connectivity Form

a. View Terminals Button

Clicking this button causes the Network-Add-Conn-View-Terminals form to appear in conjunction with the Network-Update form and the Network-Add-Connectivity form. These forms are shown in Figure 9. The Network-Add-Conn-View-Terminals form displays the origin and destination terminals of the current connection displayed on the Network-Add-Connectivity form.

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Filter/Sort Field: Button191

Network Specifications

Net-ID: 1
Last Update: 5/18/93

View Conn View POC View Doc
Add Conn Add POC Add Doc

Add Connectivities

View Term
Add Term

Connectivity ID: 1
Network: AFSCN 2

Connectivity type: PT-PT 2 Data Type: Data 2
Mode of operation: FDUX 2 Number of circuit: 1
Connectivity status (Y/N): N Security or encrypted (Y/N): N

View Terminals

Nomenclature	Location	Origin or Dest?	Terminal ID	Conn ID
MMLE-10	SUNNYVAL	Origin	1	1
FSC-78	FALCON	Dest	2	1

Record: 1

Select connectivity to find: 0 Return

Record: 1

Unique name or designator given to a terminal. FLTR NUM

Figure 9 Network-Add-Conn-View-Terminals Form

b. Add Terminals Button

Clicking this button causes the Network-Add-Conn-Add-Terminals form to appear in conjunction with the Network-Update form and the Network-Add-Connectivity form. These forms are shown in Figure 10. The Network-Add-Conn-Add-Terminals form allows a user to add a terminal to the current connectivity displayed on the Network-Add-Connectivity form. The form consists of both a main form and a subform. The main form contains the data fields that define a terminal and the subform allows a user to link the terminal to a particular connectivity. Clicking the "Return" button on this form returns the user to the Network-Add-Connectivity form.

Microsoft Access [Network Specifications]

File Edit View Records Window Help

Filter/Sort Field: Button191

Network Specifications

Net-ID: 1
Last Update: 5/18/93

View Conn View POC View Doc
Add Conn Add POC Add Doc

Add Connectivities

Connectivity ID: 1
Terminal: AFSCN

View Term
Add Term

Add Terminal to Connectivity

Terminal Specifications

Terminal ID: 1

Nomenclature: COMMERCIA User: DGS
Serial Number: 1111 Geo-Location: ONZKAFB
Reporting Designator: Region: 2
Activation Date: Deactivation Date:

Remarks: This is a commercial terminal type.

Terminal-Connectivities Specifications

Terminal ID	Connectivity ID	Origin or Dest
1	1	Origin
1	3	Dest

Record: 1

Select terminal to find: Return

Form View

Figure 10 Network-Add-Conn-Add-Terminals Form

3. View POC Button

Clicking this button causes the Network-View-POC form to appear in conjunction with the Network-Update form. These forms are shown in Figure 11. The Network-View-POC form displays the points of contact that belong to the network requirement currently shown on the Network-Update form.

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Filter/Sort: Field: Button202

Network Specifications

Net-ID: 1 View Conn View POC View Doc
 Last Update: 5/22/93 Add Conn Add POC Add Doc

Network Acronym: AFSCN Security Classification: Unclassified (Page 1 of 3)
 Network Name: AFSCN Primary Communications Netu
 Mission Definition: Provides TT&C for FLTSAT, GPS, DSP, DMSP, NATO III ar
 CINC: CINCSPCE CINC Component name: AFSPC
 CINC Priority: 1 Global Priority: 1
 Rqmt Type th: View POC
 Rqmt begin d: 878-2772 POC-ID: Network ID:
 Rqmt Type critical (Y/N): 878-2772 1 1
 ISDB Sta:
 Primary Sys:
 Network excluded (Y/N): Record 1
 Primary mission: 1 Secondary mission: 2 Tertiary mission: 3
 Return to Menu
 Record 1
 Name of the point of contact (POC) for the network: FLTR NUM

Figure 11 Network-View-POC Form

4. Add POC Button

Clicking this button causes the Network-Add-POC form to appear in conjunction with the Network-Update form. These forms are shown in Figure 12. The Network-Add-POC form allows a user to add a POC to the current network requirement shown on the Network-Update form. The form consists of both a main form and a subform. The main form contains the data that defines a point of contact and the subform allows a user to link the POC to a particular network. Clicking the "Return" button on this form returns the user to the Network-Update form.

Microsoft Access [Network Specifications]

File Edit View Records Window Help

Filter/Sort Field: Button201

Network Specifications

Net-ID: 1
Last Update: 5/18/93

View Conn View POC View Doc
Add Conn Add POC Add Doc

Add POC to Network

Network: 1

Mission: Capt William M. Major

CIN: Code 365 NPS, Box 2421

Rgmt Ty: Monterey CA Zip Code: 93943

Rgmt be: 878-2772

Rgmt Type critical

ISD

Primar

Network exclude: Select POC to find

Primar: Record: 1

POC Network Information

POC ID:	Network ID:
1	1
1	0

Record: 1

Select network to find

Return to Menu

Form View NUM

Figure 12 Network-Add-POC Form

5. View Document Button

Clicking this button causes the Network-View-Document form to appear in conjunction with the Network-Update form. These forms are shown in Figure 13. The Network-View-Document form displays the documents referenced by the network requirement currently shown on the Network-Update form.

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Filter/Sort: [?] Field: Button204 [?]

Network Specifications

Net-ID: [1] View Conn View POC View Doc
 Last Update: [5/18/93] Add Conn Add POC Add Doc

Network Acronym: [AFSCN] Security Classification: [Unclassified] (Page 1 of 3)
 Network Name: [AFSCN Primary Communications Netw]
 Mission Definition: [Provides TT&C for FLTSAT, GPS, DSP, DMSP, NATO III or
 CINC: [CINCSPACE] CINC Component name: [AFSPC]
 CINC Priority: [1] Global Priority: [1]
 Reqmt Type thrsh: [Full Period] Reqmt Type obj: [Full Period]

View-Documents

Reqmt T	Document ID	Network ID
C-21-1/6	1	1
AFSCN Communications Resources Docu	3	1
CINCSPACE OPLAN 3400-90	2	1

Record: 1

Return to Menu

Title of the reference document explaining or validating requirement FLTR NUM

Figure 13 Network-View-Document Form

6. Add Document Button

Clicking this button causes the Network-Add-Document form to appear in conjunction with the Network-Update form. These forms are shown in Figure 14. The Network-Add-Document form allows a user to add a document to the network requirement currently shown on the Network-Update form. The form consists of both a main form and a subform. The main form contains the data fields that define a document and the subform allows a user to link the document to a particular network requirement. Clicking the "Return" button on this form returns the user to the Network-Update form.

Microsoft Access - [Network Specifications]

File Edit View Records Window Help

Field: Button203

Network Specifications

Net-ID: 1
Last Update: 5/18/93

View Conn View POC View Doc
Add Conn Add POC Add Doc

Network Acronym: AFSCN Security Classification: Unclassified (Page 1 of 3)

Network
Mission Doc
CINC
Reqmt Type
Reqmt beg
Reqmt Type critical
ISDB
Primary
Network excluded
Primary

Document Information

Document ID: 1
Network ID: 1
Page Number: 1

Document Title: 2 SWG/DOX
Date: 06/09/1990

Document ID	Network ID	Page Number
1	1	C-21-1/6
1	0	

Record: 1

Document to find: Return

Record: 1

Return to Menu

Title of the reference document explaining or validating requirement

NUM

Figure 14 Network-Add-Document Form

D. CONNECTIVITY-UPDATE FORM

The Connectivity-Update form shown in Figure 15 allows a user to view, update, and/or add connectivities to the database. The form consists of the data fields that define a connectivity, two action buttons, and a "Return to Menu" button. Clicking the "Return to Menu" button causes the user to return to the View-Edit-Selection menu. The actions of the other two buttons are described in the succeeding pages.

Microsoft Access [Connectivity]

File Edit View Records Window Help

Field: Connectivity type

Connectivity Specifications

Connectivity ID: 1 View Term

Network: AFSCN Add Term

Connectivity type: 111 2 Data Type: Data 2

Mode of operation: FDLX 2 Number of circuit:

Connectivity critical [Y/N]?: N Secure or encrypted [Y/N]?: N

ISDB Number: CCSD Number:

CCSD Restore priority: System name:

Stressed data rate thrsh: 0 Stressed data rate obj: 0

Unstressed data rate thrsh: 0 Unstressed data rate obj: 0

Stressed thru-put rate thrsh: 0 Stressed thru-put rate obj: 0

Unstressed thru-put rate thrsh: 0 Unstressed thru-put rate obj: 0

Find connectivity to find: 3 Return to Menu

14 | Record 1 | 11

Type of connectivity or configuration supported NUM

Figure 15 Connectivity-Update Form

1. View Terminals Button

Clicking this button causes the Connectivity-View-Terminals form to appear in conjunction with the Connectivity-Update form. These forms are shown in Figure 16. The Connectivity-View-Terminals form displays the originating and destination terminals of the connection currently shown on the Connectivity-Update form.

Microsoft Access - [Connectivity]

File Edit View Records Window Help

Field: Button66

Connectivity Specifications

Connectivity ID: [View Term](#)

Network: [Add Term](#)

Connectivity type: Data Type:

Mode of operation: Number of circuit:

Connectivity critical (Y/N)?: Secure or encrypted (Y/N)?:

ISDB Number: CCSD Number:

CCSD Restore priority: System name:

Stressed data:

Unstressed data:

Stressed thru-put:

Unstressed thru-put:

Record: 1

View Terminals				
Terminal ID	System	Origin	Terminal ID	System
FSC-78	FALCON	Dest	2	1

Select connectivity to find: [Return to Menu](#)

Unique name or designator given to a terminal. FLTR NUM

Figure 16 Connectivity-View-Terminals Form

2. Add Terminals Button

Clicking this button causes the Connectivity-Add-Terminal form to appear in conjunction with the Connectivity-Update form. These forms are shown in Figure 17. The Connectivity-Add-Terminal form allows a user to add a terminal to the connectivity displayed. The form consists of both a main form and a subform. The main form contains the data fields that define a terminal and the subform allows a user to link the terminal to a particular connectivity. Clicking the "Return" button on this form returns the user to the Connectivity-Update form.

Microsoft Access - [Connectivity]

File Edit View Records Window Help

Filter/Sort Field: Button57

Connectivity Specifications

Connectivity ID: 1 View Term

Network: AFSCN Add Term

Add Terminal to Connectivity

Terminal ID: 1

Connectivity ID: 1

Origin or Destination: DGS

Terminal ID: 1111

Connectivity ID: 1

Origin or Destination: ONIZKAFB

Terminal ID:

Connectivity ID: 2

Origin or Destination:

Terminal ID:

Connectivity ID:

Origin or Destination:

This is a commercial terminal type.

Terminal ID	Connectivity ID	Origin or Dest
1	1	1 Origin
1	3	3 Dest
1	5	5 Origin
1	6	6 Dest

Select terminal to find. Return

Unique name or designator given to a terminal. NUM

Figure 17 Connectivity-Add-Terminal Form

E. CINC-UPDATE FORM

The CINC-Update form shown in Figure 18 allows a user to view, update and/or add CINC's and their components to the database. The CINC-Update form consists of both a main form and a subform. The main form contains the data field that defines a CINC and the subform allows a user to define the components for that CINC. Clicking the "Return-to-Menu" button on this form returns the user to the View-Edit-Selection menu.

Microsoft Access [CINC Information]

File Edit View Records Window Help

Filter/Sort: Field: CINC Name

CINC Information

CINC Name: 000001

Components of CINC

	CINC Name:	Component:
▶	CICNSPCE	AFSPC
	CICNSPCE	ARSPC
	CICNSPCE	NVSPC
*	CICNSPCE	

Record 1

Return to Menu

Name of CINC, agency or primary service NUM

Figure 18 CINC-Update Form

F. POC-UPDATE FORM

The POC-Update form shown in Figure 19 allows a user to view, update and/or add points of contact to the database. The POC-Update form consists of both a main form and a subform. The main form contains the data that defines a point of contact and the subform allows a user to link the POC to a particular network. Clicking the "Return-to-Menu" button on this form returns the user to the View-Edit-Selection menu.

Microsoft Access [POC Information]

File Edit View Records Window Help

Filter/Sort: Field: POC Full name

POC Information

POC-ID:

Rank and Full name:

Office Symbol:

Address:

City: State: Zip Code:

Commercial Phone (i.e. (719) 574-9001): DSN Phone:

STU Phone (i.e. (719) 570-8759): FAX (i.e. (719) 570-8759):

Unsecure FAX:

POC-Network Information

	POC ID:	Network ID:
▶	1	1
✱	1	0

Select POC to find:

Return to Menu

Record 1

Name of the point of contact (POC) for the network

NUM

Figure 19 POC-Update Form

G. DOCUMENT-UPDATE FORM

The Document-Update form shown in Figure 20 allows a user to view, update and/or add documents to the database. The Document-Update form consists of a main form that defines a document and a subform that allows a user to link the document to a particular network requirement. Clicking the "Return-to-Menu" button on this form returns the user to the View-Edit-Selection menu.

Microsoft Access [Document Information]

File Edit View Records Window Help

Filter/Sort: [?] Field: Classification [?]

Document Information Document ID: [1]

Document Title: [2D Space Wing OPLAN 3400-90, Space Campaign Plan]

Author: [2 SWG/DDX]

Publication Date: [06/09/1990]

Classification: [U]

Network Reference Document

	Document ID:	Network ID:	Page Number:
▶	1	1	C-21-1/6
✱	1	0	

Record: 1

Return to Menu

Overall classification of the reference document. NUM

Figure 20 Document-Update Form

H. TERMINAL-UPDATE FORM

The Terminal-Update form shown in Figure 21 allows a user to view, update and/or add terminals to the database. The form consists of a main form and a subform. The main form contains the data fields that define a terminal and the subform allows a user to link a terminal to a particular connectivity. Clicking the "Return-to-Menu" button on this form returns the user to the View-Edit-Selection menu.

Microsoft Access [Terminal Specifications]

File Edit View Records Window Help

Filter/Sort: [Terminal Nomenclature] [2]

Terminal Specifications

Terminal ID: [1]

Nomenclature: [COMMERCIAL] [2] User: [DGS] [2]

Serial Number: [1111] Geo-Location: [CNIZKAFB] [2]

Reporting Designator: [] Region: [2]

Activation Date: [] Deactivation Date: []

Remarks: [This is a commercial terminal type.]

Terminal-Connectivities Specifications

Terminal ID	Connectivity ID	Origin or Dest?
1	1	Origin
1	3	Dest
1	5	Origin
1	6	Dest
1	0	

Record 1

Return to Menu

Unique name or designator given to a terminal. NUM

Figure 21 Terminal-Update Form

I. TERMINAL-TYPE-UPDATE FORM

The Terminal-Type-Update form shown in Figure 22 allows a user to view, update and/or add terminal type specifications to the database. The form consists of a main form that specifies the actual characteristics of terminals and a subform that displays which terminal IDs and users reference this particular terminal type. Clicking the "Return-to-Menu" button on this form returns the user to the View-Edit-Selection menu.

Microsoft Access [Terminal Type Specifications]

File Edit View Records Window Help

Filter/Sort: Field: Nomenclature

Terminal Type Specifications

Nomenclature:

Operating frequency:

Terminal mobility:

Terminal platform:

Antenna size (ft):

Low EIRP (dBW):

High EIRP (dBW):

Low G/T (dB/K):

High G/T (dB/K):

Min data rate (kbps):

Max data rate (kbps):

Terminal ID:	Location:	User Name:	Serial Number:
1	SUNNYVAL	DGS	1111

Record 1

Select record to delete:

Return to Menu

Record 1

Name (Model) of a Terminal

NUM

Figure 22 Terminal-Type-Update Form

J. USER-UPDATE FORM

The User-Update form shown in Figure 23 allows a user to view, update, and/or add users to the database. The form consists of a main form and a subform. The main form defines the name and location of a particular user and the subform displays the terminals used by this particular user. Clicking the "Return-to-Menu" button on this form returns the user to the View-Edit-Selection menu.

Microsoft Access [User Specifications]

File Edit View Records Window Help

Filter/Sort: Field: User ID

User Specifications

User ID:

User-Name: CSOC

Geo-Ref-Code: AAAA

User-Region: 3

Terminals used by User

Terminal ID:	Nomenclature:	Location:	Serial Number:
2	FSC-78	FALCON	2222

Select user to find: Return to Menu

Record 1

Unique identifier of a user NUM

Figure 23 User-Update Form

K. DELETE-DIALOG FORM

The Delete-Dialog form shown in Figure 24 provides instructions on how to delete a record from the database. From this form a user can either select the "OK" button to continue or the "Cancel" button to return to the Main-Driver menu. Clicking the "OK" button causes the View-Edit-Selection menu to appear.

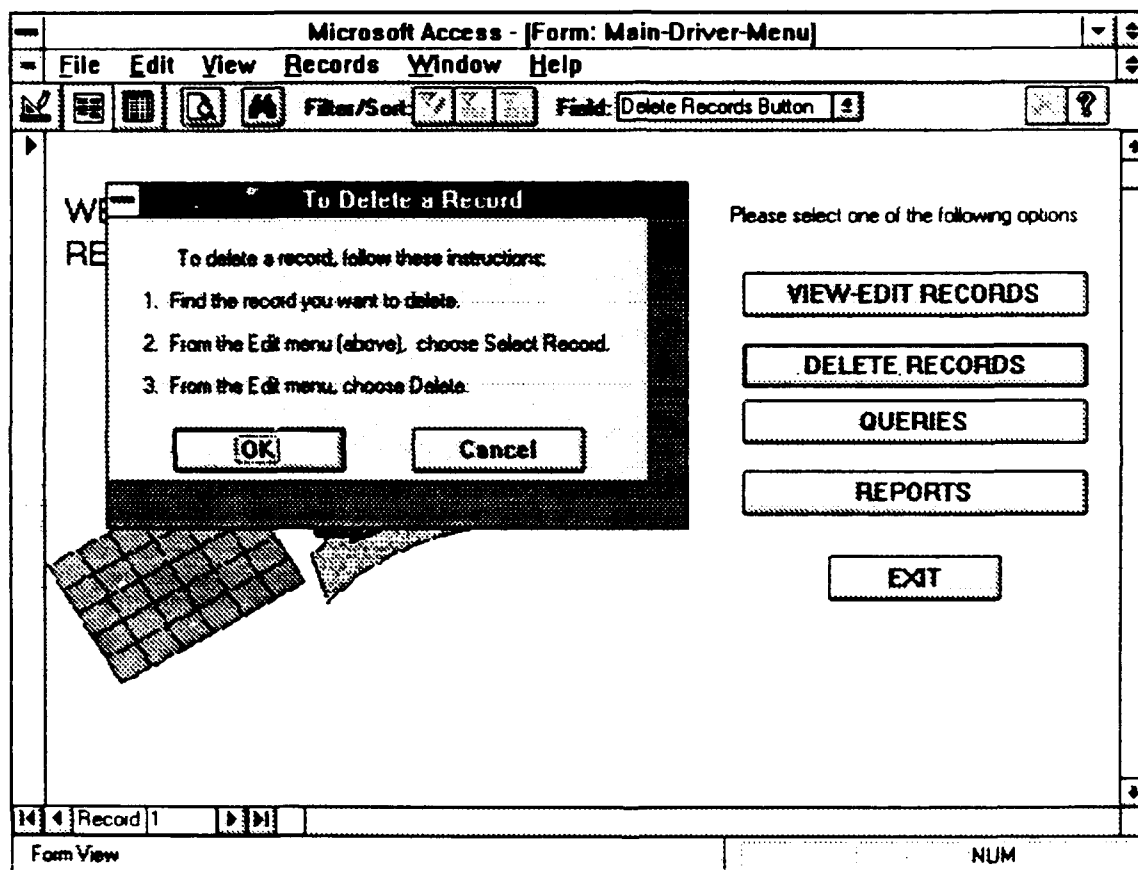


Figure 24 Delete-Dialog Form

L. QUERY-SELECTION FORM

The Query-Selection form shown in Figure 25 allows a user to select one of three predefined queries incorporated into the database. The three queries available are: Networks by Operational Dates, Networks by Cinc/Components, and Networks Limited by Requirements. The user selects one of these queries and clicks the "Preview" button to invoke the selected query. To cancel the Query-Selection form at any time, the user selects the "Cancel" button. Clicking the "Cancel" button returns the user to the Main-Driver menu. The following pages describe the forms that will appear by the query selected.

Microsoft Access - [Form: Main-Driver-Menu]

File Edit View Records Window Help

Filter/Sort: Field: Queries-Button

Queries

Please select one of the following Queries:

- ☒ Networks by Operational Dates
- ☐ Networks by CINC/Components
- ☐ Networks limited by requirements

Preview

Cancel

one of the following options

VIEW-EDIT RECORDS

DELETE RECORDS

QUERIES

REPORTS

EXIT

Record 1

Form View NUM

Figure 25 Query-Selection Form

1. Networks-by-Operational-Dates-Input Form

This form appears if the Networks by Operational Dates query is selected. The form is shown in Figure 26. On this form the user specifies the beginning and ending dates of the networks they want to query. Clicking the "OK" button causes the Nets-by-Operational-Dates-Results form to appear in conjunction with the Networks-by-Operational-Dates-Input form. These forms are shown in Figure 27. Clicking the "Cancel" button on this form returns the user to the Query-Selection form.

Microsoft Access - [Form: Main-Driver-Menu]

File Edit View Records Window Help

Filter/Sort Field: Queries-Button

Networks by Operational Dates

Please enter beginning and ending operational dates for the network you want to use.

Enter beginning date:

Enter ending date:

OK Cancel

VIEW EDIT RECORDS DELETE RECORDS QUERIES REPORTS EXIT

Record 1 NUM

Figure 26 Networks-by-Operational-Dates-Input Form

Microsoft Access - [Form: Main-Driver-Menu]

File Edit View Records Window Help

Filter/Sort Field: Queries-Button

Nets by Operational Dates

Please enter beginning and ending operational dates for the network you want to use.

Enter beginning date: 12/12/1984

Enter ending date: 12/12/1998

Network acronym that uniquely identifies a network	Beginning date	End date
AFSCN Primary Communications Net	12/31/1986	12/31/1997

VIEW EDIT RECORDS DELETE RECORDS QUERIES REPORTS EXIT

Record 1 NUM

Figure 27 Nets-by-Operational-Dates-Results Form

2. Networks-by-CINC/Components-Input Dialog

The Networks-by-CINC/Components-Input dialog (shown in Figure 28) appears on the bottom of the Query-Selection form if the Networks by CINC/Components query is selected. The user specifies the CINC and component of the networks (s)he wants to query. Clicking the "Preview" button causes one of three forms to appear depending upon what information is specified by the user. If the user specifies both a CINC and a Component, then the form Networks-by-CINC-and-Component will appear. If the user specifies a CINC and leaves the component name blank, then the form Networks-by-CINC-All-Components will appear. If the user does not specify either a CINC or a component (i.e., leaves both fields blank), then the form Networks-by-All-CINC/Components will appear. All three forms look the same. The difference between them is that each is generated by a different sub-query depending upon the information specified by the user. An example of one is shown in Figure 29. For more information regarding these sub-queries, please refer to Chapter IV, MRDB Application Queries. Clicking the "Cancel" button on this form returns the user to the Main-Driver menu.

Microsoft Access - [Form: Main-Driver-Menu]

File Edit View Records Window Help

Filter/Sort: Field: Queries-Button

Queries

Please select one of the following Queries:

- ☐ Networks by Operational Data
- ☒ Networks by CINC/Components
- ☐ Networks limited by requirements

To view only one CINC and component, select from the lists below. To view all CINCs and components, leave blank.

CINC: [1]

Component: [1]

Preview Cancel

EDIT RECORDS

DELETE RECORDS

QUERIES

REPORTS

EXIT

Record 1

Form View

NUM

Figure 28 Networks-by-CINC/Components-Input Dialog

Microsoft Access - [Form: Main-Driver-Menu]

File Edit View Records Window Help

Filter/Sort: Field: Queries-Button

Queries

Please select one of the following Queries:

- ☐ Networks by Operational Data
- ☒ Networks by CINC/Components
- ☐ Networks limited by requirements

To view only one CINC and component, select from the lists below. To view all CINCs and components, leave blank.

CINC: [1]

Component: [1]

Preview Cancel

EDIT RECORDS

DELETE RECORDS

QUERIES

REPORTS

EXIT

Networks by CINC and Component

CINC	Component	Acronym	Net ID	Network Name
AFSPC	AFSCN	1	AFSCN Primary Communications Net	
AFSPC	VCF	3	Vehicle Checkout Facilities	

Record 1

Component: AFSPC

Form View

NUM

Figure 29 Network-by-CINC-and-Component Form

3. Networks-Limited-by-Requirements-Input Form

This form (shown in Figure 30) appears if the Networks Limited by Requirements query is selected. On this form the user specifies the requirements of the networks they want to query. Clicking the "Preview" button causes one of two forms to appear depending upon what information is specified by the user. If the user specifies a satisfaction level, then the form Networks-by-Satisfaction-Level will appear. If the user does not specify a satisfaction level (i.e., the user leaves the field blank), then the form Networks-by-All-Satisfaction-Levels will appear. Both of these forms look the same. The difference between them is that each is generated by a different sub-query depending upon the information specified by the user. An example of one is shown in Figure 31. For information regarding these sub-queries, please refer to Chapter IV, MRDB Application Queries.

Figure 30 Networks-Limited-by-Requirements-Input Form

Network Acronym	Network Name	Rating
AFSON	AFSON Primary Cor	1
	(Counter)	

Figure 31 Networks-by-All-Satisfaction-Levels Form

M. REPORT-SELECTION FORM

The Report-Selection form shown in Figure 32 allows a user to either preview or print the reports available in the database. The two available reports are the Detailed report and the Terminal User report. After selecting the desired report, the user will be prompted for a network acronym. The user can either enter a network acronym for the network to be printed, or (s)he can leave the field blank to print all networks. The user then selects the appropriate button - "Preview", "Print", or "Cancel" accordingly. Pressing the "Preview" button allows a user to preview the report before printing it, pressing the "Print" button sends the report directly to the printer, and pressing the "Cancel" button returns the user to the Main-Driver-Menu.

Microsoft Access - [Form: Main-Driver-Menu]

File Edit View Records Window Help

Filter/Sort: Field: REPORTS Button

Reports

Please select one of the following Reports:

☒ Detailed Report

☐ Terminal User Report

To print all networks leave Network Acronym field blank.
Otherwise enter an valid network acronym to print.

Network Acronym:

one of the following options

Preview

Print

Cancel

EDIT RECORDS

DELETE RECORDS

QUERIES

REPORTS

EXIT

Record 1

Form View NUM

Figure 32 Report-Selection Form

VI. MRDB APPLICATION REPORTS

Reports are a meaningful way to present data in printed form [Ref. 5:p. 396]. Like a form, a report can be organized and formatted to a user's specifications [Ref. 5:p. 396]. A report can be previewed on a user's terminal screen or it can be directed to a printer for hard copy printout [Ref. 4:p. 140]. In this database application, two reports can be generated, the Detailed report and the Terminal User report. A user can run these reports for all network requirements or for a specific one. These reports are discussed in the next two sections.

A. DETAILED REPORT

The Detailed report, shown in Figure 33, includes the data fields that define a network requirement. This report is produced by the Detailed-Main-Report and four subreports that are linked to it. "A subreport is a report that is inserted into another report." [Ref. 5:p. 464] A subreport contains information related to the main report but due to software limitations in Access, cannot be included in the main report [Ref. 5:p. 472]. For example, if a table has a one-to-many relationship with two or more tables or queries, then a subreport is required to print all the data in one report

*** Unclassified ***
Network Description Objective

Responsible CINC: CINSPC
 Component: AFSPC
 Primary System: DSCS
 Secondary System: Commercial
 U.S. Control: Y
 Requirement Type: Full Period
 Network ID: I

Satisfaction: P
 Validation Status: JCS Validated
 Operational Dates: 12/31/1986 to 23/1/1997
 CINC Priority: I
 MILSATCOM Priority:
 Essentiality: I
 Exclude: N

Concept of Operation: Provides TT&C for FLTSAT, GPS, DSP, DMSP, NATO III and DSCS between CSOC and the RTS's

Impact if not satisfied:

Survivability / Technical Parameters

Conflict Levels	Scenarios	BK Error Rate:	thrash:
1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	5	0
Y Y Y Y Y N N N	Y Y Y Y Y N N N	20.00%	1 seconds
		Minimum Message Transmittal Time:	1 seconds
		Maximum Allowable Access Time:	1 seconds
		Duty cycle thrash:	1

Originator Information

Originator of Requirement: Code 365
 Office Symbol: Code 365
 Commercial Number:
 Secure FAX Number:
 DSN Number: 878-2772
 STU-III Number:
 Unsecure FAX Number:

Reference

Document Title	Author	Date	Page #	Classification
2D Space Wing OPLAN: 3400-90, Space Campaign Plan	2 SW/G/DOX	06/09/1990	C-21-1/6	U
AFSCN Communications Resources Document	SSD/CWOD	03/31/1991	C-21-1/C-22-3	FOUO
CINCSpace OPLAN: 3400-90	CINCSpace	06/09/1991	C-21-1/6	FOUO

Unclassified

Connectivity

Connect Type	Data Type	Stressed Data Rate	Unstressed Data Rate	Op Mode	# Chds	User	ORIGIN			DESTINATION		
							Mobility	Platform	User	Mobility	Platform	ISDR
PT-PT	Data	0	0	FDUN		DGS	Mobile	Man	CSOC	Mobile	Truck	
PT-PT	Data	0	0	FDUN		CSOC	Mobile	Truck	CSTC	Fixed	Sub	
PT-PT	Video	0	0	HDUN	0	CSTC	Fixed	Sub	DGS	Mobile	Man	

[Ref. 5:p. 472]. These subreports are then linked to the main report to produce the complete report [Ref. 5:pp. 472-473]. As shown in Figure 33, the Detailed report consists of five sections - the Network Description Objective, the Survivability/Technical Parameters, the Originator Information, Reference information, and Connectivity information. These sections are discussed in the following paragraphs.

1. Network Description Objective Section

This section displays basic information regarding a network requirement such as the network acronym and name, the responsible CINC and component, the satisfaction level, the network's missions and other general information regarding the requirement. This information is obtained from the Network table and is produced by the Detailed-Main-Report.

2. Survivability/Technical Parameters Section

This section describes the survivability and technical parameters of a network requirement. It displays the anti-jamming and low probability of intercept thresholds, the conflict levels and scenarios, the bit error rate, the minimum availability, the maximum message transmit time, the maximum allowable access time, and the duty cycle threshold. This information is obtained from the Network table and is produced by the Detailed-Main-Report.

3. Originator Information Section

This section displays information regarding the points of contact for a network requirement. It displays the names of the points of contact, their office symbols and their important telephone numbers. This information comes from the POC table and is produced by the Detailed-POC-Subreport.

4. Reference Information Section

This section displays the documents referenced by a network requirement. It displays the document title, author, publication date, page numbers, and classification of these documents. This information is obtained from the Document and Network-Ref-Document tables and is produced by the Detailed-Doc-Subreport.

5. Connectivity Information Section

This section displays the connectivities that make up a network requirement. It displays the connectivity and data types of each connection, their stressed and unstressed data rates, their operation mode and number of circuits, and general information regarding the terminals located at the origin and destination sites of these connections. This information comes from a composite of several different tables - the Connectivity table, the Terminal table, the Terminal-Connect table, and the Terminal Type table. This section is produced by two subreports - the Detailed-Origin-Subreport and the Detailed-Destination-Subreport. The Detailed-Origin-

Subreport prints out basic information for each connectivity (such as the connectivity type, data type, data rates, etc.) and information regarding the originating terminals of these connections. The Detailed-Dest-Subreport prints out the information regarding the destination terminals of these connections.

B. TERMINAL USER REPORT

The Terminal User report, shown in Figure 34, displays the terminals and the users who use those terminals for all connections of a network requirement. The report is produced by the Terminal-User-Main-Report and two subreports linked to it. As shown in Figure 34, the report is broken up into three sections - the Network Description section, the Origin User/Terminal section, and the Destination User/Terminal section. These sections are discussed in the following paragraphs.

1. Network Description Section

This section displays basic information related to a network requirement such as the network acronym and name, the responsible CINC and component, the satisfaction level, the network's missions and other general information regarding the requirement. This information is obtained from the Network table and is produced by the Terminal-User-Main-Report.

Terminal User Report

27 May 93

... Unclassified ...

Network Acronym: AFSCN		Responsible CINC: CINCSPACE		Satisfaction Level: P	
Network Name: AFSCN Primary Communications Net		Component: AFSPC		Validation Status: JCS Validated	
Primary mission: 1		Primary System: DSCS		Operational Dates: 12/31/1986 to 12/31/1997	
Secondary mission: 3		Secondary System: Commercial		CINC Priority: 1	
Tertiary mission: 2		U.S. Control: Y		MILSATCOM Priority:	
GR-GP Area: 1		Requirement Type: Full Period		Essentiality: 1	
Critical: Y		Network ID: 1		Exclude: N	

Concept of Operation: Provides TT&C for FLTSAT, GPS, DSP, DMSP, NATO III and DSCS between CSOC

Impact if not satisfied:

Unclassified

User/Terminal Data

ORIGIN						DESTINATION					
User	Loc	Sc	Rg	Sc	Rg	Loc	Sc	Rg	Sc	Rg	Rd
CSOC	FALCON	CO	3	FSC-78	FALCON	CO	20	2	2222	FIN	DE
CSTC	DIEGOGGR	IO	15	GSC-39	DIEGOGGR	IO	21	3	3333	DE	
DGS	SUNNYVA	CA	12	COMMERC	SUNNYVA	CA	2	1	1111	FIN	

Figure 34 Terminal User Report

2. Origin User/Terminal Section

This section displays the users and the terminals located at the originating locations of each connectivity for a network requirement. It displays the originating users and their locations as well as the originating terminals and their locations for each connection. The information comes from a composite of three tables - the Terminal table, the User table, and Geo-Location table, and is produced by the Term-User-Origin-Subreport.

3. Destination User/Terminal Section

This section displays the destination users and their locations as well as the destination terminals and their locations for each connection of a network requirement. The information comes from a composite of three tables - the Terminal table, the User table, and Geo-Location table, and is produced by the Term-User-Dest-Subreport.

This chapter and the two preceding ones described the MRDB application of queries, forms, and reports in the database system. The next chapter describes how macros and modules are used to integrate these queries, forms, and reports into a customized menu-driven database system.

VII. MRDB APPLICATION MACROS AND MODULES

This chapter describes the macros and modules used by the database application. Section A defines each macro and describes the actions that result by invoking them. Section B defines modules and describes the "IsLoaded" function used by the database system.

A. MACROS

Macros are used to automate routine or repetitive tasks and integrate a set of menus, forms, queries, and reports into a customized menu-driven system. Macros consist of actions that are executed when a user selects a particular option from a menu or a form. An action could be to open a new form, close a current one, run a report, or execute a query. This database application includes 15 macros. The following sections briefly define the purpose of each macro and describe the actions performed by them.

1. Auto-Exec Macro

The purpose of the Auto-Exec macro is to initiate the MRDB database. Executing this macro opens and displays the Main-Driver menu. From this menu, a user can select and perform the functions available in the menu-driven system by clicking the appropriate button on the form.

2. Main-Driver Macro

The purpose of the Main-Driver macro is to open and display the forms associated with the Main-Driver menu. The Main-Driver menu allows a user to select from five functions by pointing and clicking the appropriate button on the menu. The five choices and the actions that result by selecting them are described below.

a. View-Edit Button

Clicking this button causes the macro to open and display the View-Edit-Selection menu.

b. Delete Button

Clicking this button causes the macro to open and display the Delete-Dialog form.

c. Queries Button

Clicking this button causes the macro to open and display the Query-Selection form.

d. Reports Button

Clicking this button causes the macro to open and display the Report-Selection form.

e. Exit Button

Clicking this button causes the macro to close the Main-Driver menu and return to the initiating application.

3. View-Edit-Selection Macro

The purpose of the View-Edit-Selection macro is to open and display the forms associated with the View-Edit-

Selection menu. A user can select from nine different buttons on the View-Edit-Selection form. The nine buttons and the actions that result by selecting them are described below.

a. View Network Requirements Button

Clicking this button causes the macro to open and display the Network-Update form. When the form is opened, the macro displays the first network requirement record from the Network table.

b. View CINC Button

Clicking this button causes the macro to open and display the CINC-Update form. When the form is opened, the macro displays the first CINC record from the CINC table.

c. View POC Button

Clicking this button causes the macro to open and display the POC-Update form. When the form is opened, the macro displays the first POC record from the POC table.

d. View DOC Button

Clicking this button causes the macro to open and display the Document-Update form. When the form is opened, the macro displays the first document record from the Document table.

e. View Connectivity Requirements Button

Clicking this button causes the macro to open and display the Connectivity-Update form. When the form is

opened, the macro displays the first connectivity record from the Connectivity table.

f. View Terminal Button

Clicking this button causes the macro to open and display the Terminal-Update form. When the form is opened, the macro displays the first terminal record from the Terminal table.

g. View Terminal-Type Button

Clicking this button causes the macro to open and display the Terminal-Type-Update form. When the form is opened, the macro displays the first terminal-type record from the Terminal-Type table.

h. View User Button

Clicking this button causes the macro to open and display the User-Update form. When the form is opened, the macro displays the first user record from the User table.

i. Return Button

Clicking this button causes the macro to close the View-Edit-Selection form and returns the user to the Main-Driver menu.

4. Network-Update Macro

The purpose of the Network-Update macro is to open and display the forms associated with the Network-Update form. The user can select from seven different buttons on the

Network-Update form. The seven buttons and the actions that result by selecting them are described below.

a. View Connectivities Button

Clicking this button causes the macro to open and display the Network-View-Connectivity form in conjunction with the Network-Update form.

b. Add Connectivity Button

Clicking this button causes the macro to open and display the Network-Add-Connectivity form in conjunction with the Network-Update form. When the form is opened, the macro displays the first connectivity record from the Connectivity table.

c. View POC Button

Clicking this button causes the macro to open and display the Network-View-POC form in conjunction with the Network-Update form.

d. Add POC Button

Clicking this button causes the macro to open and display the Network-Add-POC form in conjunction with the Network-Update form. When the form is opened, the macro displays the first POC record from the POC table.

e. View Document Button

Clicking this button causes the macro to open and display the Network-View-Document form in conjunction with the Network-Update form.

f. Add Document Button

Clicking this button causes the macro to open and display the Network-Add-Document form in conjunction with the Network-Update form. When the form is opened, the macro displays the first document record from the Document table.

g. Return to Menu Button

Clicking this button causes the macro to close the Network-Update form and returns the user to the View-Edit-Selection menu.

5. Network-Add-Connectivity Macro

The purpose of the Network-Add-Connectivity macro is to open and display the forms associated with the Network-Add-Connectivity form. From the Network-Add-Connectivity form a user can select from three different buttons. These buttons and the actions that result by selecting them are described below.

a. View Terminals Button

Clicking this button causes the macro to open and display the Network-Add-Conn-View-Terminals form in conjunction with the Network-Update form and the Network-Add-Connectivity form.

b. Add Terminals Button

Clicking this button causes the macro to open and display the Network-Add-Conn-Add-Terminals form in conjunction with the Network-Update form and the Network-Add-Connectivity

form. When the form is opened, the macro displays the first terminal record from the Terminal table.

c. Return Button

Clicking this button causes the macro to close the Network-Add-Connectivity form and returns the user to the Network-Update form.

6. Connectivity-Update Macro

The purpose of the Connectivity-Update macro is to open and display the forms associated with the Connectivity-Update form. From the Connectivity-Update form a user can select from three different buttons. The three buttons and the actions that result by selecting them are described below.

a. View Terminals Button

Clicking this button causes the macro to open and display the Connectivity-View-Terminals form in conjunction with the Connectivity-Update form.

b. Add Terminals Button

Clicking this button causes the macro to open and display the Connectivity-Add-Terminal form in conjunction with the Connectivity-Update form. When the form is opened, the macro displays the first terminal record from the Terminal table.

c. Return to Menu Button

Clicking this button causes the macro to close the Connectivity-Update form and returns the user to the View-Edit-Selection menu.

7. Delete-Dialog Macro

The purpose of the Delete-Dialog macro is to open and display the forms associated with the Delete-Dialog form. From the Delete-Dialog form a user can select from two different buttons. The two buttons and the actions that result by selecting them are described below.

a. OK Button

Clicking this button causes the macro to close the Delete-Dialog form and open and display the View-Edit-Selection menu.

b. Cancel Button

Clicking this button causes the macro to close the Delete-Dialog form and returns the user to the Main-Driver menu

8. Query-Selection Macro

The purpose of the Query-Selection macro is to open and display the forms associated with the Query-Selection form. From the Query-Selection form a user can select from three queries and then select either the "Preview" button or the "Cancel" button. The "Preview" button causes the macro to request additional information for the query whereas the

"Cancel" button will stop the query process and return the user to the Main-Driver menu. The four choices available and the actions that result from them are described below.

a. Networks by Operational Dates and Preview Button Selected

Selecting these options causes the macro to open and display the Networks-by-Operational-Dates-Input form.

b. Networks by CINC/Components Selected

Selecting this option causes the macro to prompt the user to specify the CINC and component for the query. Once this information is specified, the user can select the "Preview" button to execute the query or the "Cancel" button to cancel the query. If the user selects the "Preview" button then the macro will execute and display the results in an appropriate form. (See Chapter V, MRDB Application Forms, Section L.2, for more information on these forms). If the user selects the "Cancel" button then the macro will close the Query-Selection form and return the user to the Main-Driver menu.

c. Networks Limited by Requirements and Preview Button Selected

Selecting these options causes the macro to open and display the Networks-Limited-by-Requirements-Input form.

d. Cancel Button Selected

Selecting this button causes the macro to close the Query-Selection form and returns the user to the Main-Driver menu.

9. Networks-by-Operational-Dates-Input Macro

The purpose of this macro is to open and display the forms associated with the Networks-by-Operational-Dates-Input form. From the Networks-by-Operational-Dates-Input form a user can specify the beginning and ending operational dates of the networks (s)he wants to query. Once these dates have been entered, the user can select the "OK" button to execute the query or the "Cancel" button to cancel the query. The two buttons and the actions that result by selecting them are described below.

a. OK Button

Clicking this button causes the macro to display the results of the query by opening the Nets-by-Operational-Dates-Results form.

b. Cancel Button Selected

Clicking this button causes the macro to close the Networks-by-Operational-Dates-Input form and returns the user to the Query-Selection form.

10. Networks-Limited-by-Requirements Macro

The purpose of this macro is to open and display the forms associated with the Networks-Limited-by-Requirements-

Input form. From the Networks-Limited-by-Requirements-Input form a user can specify the criteria for the networks (s)he wants to query. Once this information is entered, the user can select the "OK" button to execute the query or the "Cancel" button to cancel the query. The two buttons and the actions that result by selecting them are described below.

a. OK Button

Clicking this button causes the macro to display the results of the query by opening the Networks-by-All-Satisfaction-Levels form or the Networks-by-Satisfaction-Level form. The Networks-by-All-Satisfaction-Levels form is opened and displayed if a user does not restrict the query to a particular satisfaction level. However, if a user does restrict the query to a particular satisfaction level, then the macro will open and display the Networks-by-Satisfaction-Level form.

b. Cancel Button

Clicking this button causes the macro to close the Networks-Limited-by-Requirements-Input form and returns the user to Query-Selection form.

11. Report-Selection Macro

The purpose of the Report-Selection macro is to open and display the reports associated with the Report-Selection form. From the Report-Selection form a user can select to preview or print the Detailed Report or the Terminal User

Report. When a user selects one of these reports, the Report-Selection macro will prompt the user for a network acronym. A user can enter a network acronym for the network requirement (s)he wants to print, or (s)he can leave the field blank and print the report for all network requirements. Once this information is entered, a user can then select the "Preview" button to preview the report, the "Print" button to print the report, or the "Cancel" button to return to the Main-Driver menu. Each of these buttons and the actions that result by selecting them are described below.

a. Preview Button

Clicking this button causes the macro to open either the Detailed-Main-Report or the Terminal-User-Main-Report in "Print Preview" mode.

b. Print Button

Clicking this button causes the macro to open either the Detailed-Main-Report or the Terminal-User-Main-Report in "Print" mode.

c. Cancel Button

Clicking this button causes the macro to close the Report-Selection form and returns the user to the Main-Driver menu.

12. Find-Record Macro

The purpose of this macro is to find a specific record while a user is viewing records on a form. This macro exists

for the following tables: Network, Connectivity, CINC, POC, Document, Terminal, Terminal-Type, and User. Each of these tables has a corresponding form that allows a user to view and edit these records. On the bottom of each form is a Find dialog box. In the Find dialog box a user can specify the record (s)he wishes to locate. This information is then used by the macro to find and display the specified record on the form. [Ref. 5:pp. 546-547]

13. Show-Related-Conn-POC-Doc Macro

The purpose of this macro is to keep the Network-View-Connectivity form, or the Network-View-POC form, or the Network-View-Document form (if one of these forms is currently opened) synchronized with the current network requirement record as a user moves from record to record on the Network-Update form. [Ref. 5:pp. 536-537]

14. Show-Related-Terminals Macro

The purpose of this macro is to keep the Connectivity-View-Terminals form (if opened) synchronized with the current connectivity requirement as a user moves from record to record on the Connectivity-Update form. [Ref. 5:pp. 536-537]

15. Return Macro

This is a generic macro that can be invoked by any form. The purpose of this macro is to close the form that invoked the macro.

B. MODULES

Modules are procedures written in Access Basic for tasks too complicated or complex for a macro to handle. This database includes one procedure. The procedure performs the "IsLoaded" function to check whether a form is open or not. This function is invoked to keep two forms synchronized. The "IsLoaded" function determines if the second form is open prior to the database attempting to display the forms in synchronized format. The "IsLoaded" function was developed by Microsoft and was imported into this database from their Northwind database application. A copy of the code can be found in Appendix C.

VIII. CONCLUSIONS AND RECOMMENDATIONS

The underlying goal of this thesis was to develop a prototype PC based interactive, graphical and user friendly database system for U.S. Space Command that allows them to manage the MRDB database "in-house". The prototype database system developed for this thesis, using Microsoft Access relational database system, is PC based, is interactive, is graphical, is user friendly and will allow U.S. Space Command to manage their database "in-house", therefore achieving its stated purpose. Traditional database design methodologies were used to develop the prototype. Microsoft Access allowed the prototype database system to be developed quickly, taking full advantage of the graphical capabilities available in Windows. These capabilities provided the visual and graphical features desired by U.S. Space Command. The six phase database design process ensured that a functional database system would be developed. Even though this prototype database system achieved its desired goals, improvements can be made as discussed in Section B.

It should be noted that the database system developed for this thesis is a prototype and as such should not be considered a final product for U.S. Space Command. While the prototype is a solid, workable database system, there are

three actions that should be accomplished before its final implementation:

1. Convert the current MRDB database into the new MRDB structure defined in this thesis.
2. Test and fully evaluate the prototype database system with the new MRDB structure.
3. Obtain feedback from users on their functional requirements (i.e., queries and reports).

Once these actions have been accomplished, U.S. Space Command will then be able to use the application as a production system. It should be noted, however, that in order for U.S. Space Command to successfully manage the database "in-house", attention must be given to database administration functions - such as data integrity, database security, backup, and recovery. Microsoft Access provides some of these administration functions.

Access can enforce referential integrity rules if the "Enforce Referential Integrity" option is selected by the designer of the database. Referential integrity rules prevent a user from accidentally deleting related data from the database and helps ensure that data in the database is related in a valid way. [Ref. 5:p. 54]

Access also provides security by assigning each authorized person a unique user name and a four-digit personal ID number.

A logon dialog will then be used to prevent unauthorized users from accessing the database system. [Ref. 5:p. 612]

Backing up a database is one of the most important administrative functions that needs to be performed on a regular basis. Backing up the database protects the user from any major loss or damage to the database. Procedures on how often a database should be backed up depend upon the importance of the data and how often it is updated. Backing up a database in Microsoft Access is easy because the entire database is stored in one file. [Ref. 5:p. 611]

Access also provides some rudimentary recovery capabilities. If an Access application terminates before a user has a chance to close it, then the database can be left in an inconsistent state and may need to be recovered. When a user tries to open the database, Access will automatically check for any errors and display a message indicating whether the database is in need of repair. If so, a user can select the OK button and Access will repair the database. [Ref. 5:p. 628]

We recommend that a database administrator be assigned to maintain the MRDB database to ensure that the above functions are performed.

A. ADVANTAGES AND BENEFITS OF THE PROTOTYPE DATABASE SYSTEM

The current operating environment requires U.S. Space Command to task its subcontractor to run queries and reports.

The major advantages and benefits of the prototype database system over this method of operation are discussed below.

1. The database system uses a graphical user interface

The prototype database system uses extensive visual features to make the database system more user friendly. Standard graphical user interface elements such as pull-down menus, forms, buttons, scroll bars, etc. enhance the readability and usability of the database system. Macros link the various forms, menus, queries and reports used by the database system into a customized menu-driven system. This menu-driven capability combined with the graphical features available in Access provides a user friendly environment.

2. The database system is interactive

The prototype database system allows a user to access and manipulate the data in the database interactively. This allows a user to view records or execute a query or a report immediately from a personal computer without having to wait for the services of a contractor. This greatly decreases the turn around time to obtain information.

3. The database system can be managed "in-house"

With a PC based system, U.S. Space Command will be able to manage the MRDB database "in-house", i.e., it will no longer need the services of a contractor to update or query the database. U.S. Space Command will now have the capability

to update the database themselves and execute and run common queries and reports easily.

4. The database system will save U.S. Space Command time and money

If U.S. Space Command uses this database system to manage the MRDB "in-house", then a contractor is no longer needed to maintain the MRDB database. This saves money. In addition there will no longer be the time delays that occur when using a contractor. For example, instead of U.S. Space Command requesting a query or a report and waiting for the contractor to provide it, U.S. Space Command will now be able to do these tasks themselves immediately.

B. RECOMMENDATIONS

Even though the prototype database system achieved its desired goals, improvements can still be made.

1. Add more reports to the database system

The prototype database system produces the two most critical reports - the Detailed report and the Terminal User report. U.S. Space Command uses other reports periodically that need to be included in the system. They are the Form 772 report, the Terminal Summary Report, the Summary report, and the Requirement Summary reports.

2. Add a Print Option to the Query Application

When a user queries the database for network requirements, a listing of the networks that match the search

criteria is printed on the screen. A user cannot produce these results by invoking a predefined report. A "print" option would be a nice feature to include in the Query application. The "print" option could be used to print the results of the query or to generate a report using the results of the query as the input.

3. More queries could be added to the database system

Included into the design of the database system are three of the more common queries used by U.S. Space Command. However several other predefined queries could also be incorporated into the database system. In addition, the Query by Example feature available in Access could be included as a option in the database system for ad hoc queries requested by knowledgeable users.

4. A summary log of a user's session should be added

A summary log of a user's session could be included in the database system. This log should show the actions that occurred during a terminal session and the results of those actions.

5. A extensive HELP facility should be included in the database system

Even though a rudimentary HELP system is included in the prototype database system, it would be extremely useful to have a context-sensitive comprehensive HELP system similar to those found in other software applications.

C. CLOSING REMARKS

The prototype database system developed for this thesis shows how U.S. Space Command can benefit by its implementation. The prototype database system has several advantages over the existing one - it is graphical, interactive, user friendly, and will allow U.S. Space Command to manage the MRDB database "in-house". By implementing this database system, U.S. Space Command will be able to save both time and money by not having to rely on a contractor to query and maintain the database. The intent of this thesis was to develop an alternative database system for U.S. Space Command that would be more efficient and more cost effective than the current one. The Access version of the MRDB achieves this objective.

APPENDIX A - MRDB TABLES

Field	Data Type	Notes
Table: CINC		
<u>CINC name</u>	text(11)	name of CINC, agency or primary service
Table: COMPONENT		
CINC name	text(11)	name of CINC, agency or primary service
<u>component</u>	text(8)	a component or service of a CINC
Table: CONNECTIVITY		
<u>connectivity ID</u>	counter	uniquely identifies a connectivity; indexed
network id	long integer	foreign key
connectivity type	text (5)	config:"pt-pt, pt-mp, rptbk, hbspk, bdcst, or conf"
data type	text (5)	"data, voice, image, video, or fax"
secure data transmission rate	text (1)	indicates if the data transmitted must be secured or encrypted
<u>ccsd number</u>	text (8)	Command Communications Service Designator number; unique id for circuits, package circuit, truck circuits; major control element in DISA database;
ccsd restore priority	text(2)	relative importance of circuit for restoration
isdb number	text (13)	control number which uniquely identifies a requirement in the ISDB
system name	text (10)	name of the satellite system carrying the circuit
mode of operation	text (4)	"fdux, hdux, splx"
number of circuits	integer	number of circuits involved in the connectivity; number between 0 and 99
connectivity critical	text (1)	identifies if connectivity critical to network
stressed data rate obj	double	objective kbps supported in presence of jamming or scintillation
stressed data rate thrsh	double	threshold kbps supported in presence of jamming or scintillation
stressed thru-put rate obj	double	total stressed throughput objective of a connectivity
stressed thru-put rate thrsh	double	total stressed throughput threshold of a connectivity
unstressed data rate obj	double	objective kbps w/o jamming or scintillation; if no aj, leave blank
unstressed data rate thrsh	double	threshold kbps w/o jamming or scintillation; if no aj, leave blank
unstressed thru-put rate obj	double	total unstressed throughput objective of a connectivity
unstressed thru-put rate thrsh	double	total unstressed throughput threshold of a connectivity

Table: Document		
document ID	counter	unique identifier for a document
document title	text(70)	title of the reference document explaining or validating requirement
author	text(15)	organization or person who created the referenced document
publication date	mm/dd/yyyy	publication date of the reference document
classification	text(5)	overall classification of the reference document
Table: GEO-Location		
geographic reference code	text(4)	unique identifier for each geographic location
location	text(8)	location of a communication terminal or facility as listed in USGS publication
state-country code	text(2)	state or country of a user's location according to federal standard
area code	text(1)	identifies the DCA area; between 1 and 9
country abbreviation	text(5)	five character abbreviation of a foreign country or domestic state
full location name	text(25)	full spelling of the coded 8 character DISA user location
latitude degrees	integer	degrees away from the equator of the user's location; between 0 and 90
latitude minutes	integer	minutes away from the equator of the user's location; between 0 and 60
latitude seconds	integer	seconds away from the equator of the user's location; between 0 and 60
latitude hemisphere	text(1)	latitudinal hemisphere in which the user's is located "N" or "S"
longitude degrees	integer	degrees away from the zero meridian of the user's location; between 0 and 180
longitude minutes	integer	minutes away from the equator of a user's location; between 0 and 60
longitude seconds	integer	seconds away from the zero meridian of a user's location; between 0 and 60
longitude hemisphere	text(1)	longitudinal hemisphere of the user's location; "E" or "W"
Table: NETWORK		
net-ID	counter	network identification number that uniquely identifies a network
network name	text(35)	description of network
mission definition	text(100)	end mission of network requirement
cinc	text(10)	responsible cinc/agency for network requirement; indexed
cinc component name	text(8)	specific component or service of network req; indexed
network acronym	text(10)	network acronym that uniquely identifies a network
security classification	text(12)	overall security classification of network; "unclassified" or "secret"; not above secret
cinc priority	text(3)	priority of requirement; assigned by cinc/agency
global priority	text(2)	assigned by ISDB
rqmt type obj	text(11)	requirement type objective; type of support; "full period or on call"
rqmt type thrsh	text(11)	requirement type threshold; type of support; full period = dedicated; on-call = contingency
rqmt type critical	text(1)	if critical for completion of unit's mission; "y or n"
rqmt duration	integer	duration of reqmt; usually use for short term requirements; in days

rqmt begin date	mm/dd/yyyy	first date of validity; mm/dd/yy
rqmt end date	mm/dd/yyyy	date no longer valid; mm/dd/yy
isdb status	text(15)	status of req. thru the validation process
satisfaction	text(1)	present level of satisfaction for req; "U-unsat, P-partial, F-future, S-satisfied"
primary system	text(12)	primary system that satisfies the reqmt; satellite system or freq band
secondary system	text(12)	backup system which satisfies the reqmt
network excluded	text(1)	flag a network as being deleted from the MRDB
network critical	text(1)	flag a network if critical for completion of a unit's mission
aj required	text(1)	network require anti-jam protection?; "y,n"
aj critical	text(1)	anti-jam requirement critical to the network?; "y,n"
aj level obj	integer	expected power level of jammer; 0 - 4
aj level thrsh	integer	threshold power level of jammer; 0 - 4
aj dist obj	integer	anti-jam distance objective; distance between user location and jammer location; 0 - 3
aj dist thrsh	integer	anti-jam distance threshold; threshold distance between user location and jammer location
lpi required	text(1)	low probability of intercept required for the network?; "y,n"
lpi critical	text(1)	low probability of intercept critical to the network?; "y,n"
lpi dist obj	integer	lpi distance objective; distance from user that there is a low probability of signal intercept; 1 - 3
lpi dist thrsh	integer	lpi distance threshold; threshold distance from the user that there is a lpi; 1 - 3
emp critical	text(1)	electromagnetic pulse protection critical; is hardening EMP protection critical to the operation of the network requirement; "y,n"
emp obj	text(1)	emp objective
emp thrsh	text(1)	emp threshold
nsp required	text(1)	nuclear scintillated protection required?; "y,n"; does network need to transmit through a nuclear scintillated environment
maxout obj	integer	in seconds, the maximum time a network transmission may be interrupted due to weather; between 0 and 99999 secs
maxout thrsh	integer	in seconds, the threshold max time a network transmission may be interrupted due to weather; between 0 and 99999 secs
min avail obj	double	objective minimum percent of time a network needs to be available to the user; percent 0 - 100
min avail thrsh	double	threshold min percent of time a network needs to be available to a user; percent 0 - 100
avg-calls-per-hour	integer	frequency of calls per hour made by the user
avg-length-of-call	double	in minutes (ex 11.5), the avg length of each call or transmission
duty cycle critical	text(1)	is duty cycle requested critical to the operation of the network?; "y,n"
dutv cycle obj	double	objective percent a network is required to support a transmission
duty cycle thrsh	double	threshold percent a network is required to support a transmission
ber critical	text(1)	is bit error rate (BER) critical to the operation of the network
ber mantissa	double	mantissa of BER
ber exponent obj	integer	identifies the objective exponent of the max BER (service quality) required by the network; 0 - 99

ber exponent thrsh	integer	identifies the threshold exponent of the max BER (service quality) required by the network; 0 - 99
conflict_1	text(1)	does network need to be operational during conflict level 1 (peace)
conflict_2	text(1)	level 2 (low intensity conflict)
conflict_3	text(1)	level 3 (crisis)
conflict_4	text(1)	level 4 (theater conventional war)
conflict_5	text(1)	level 5 (global conventional war)
conflict_6	text(1)	level 6 (theater nuclear war)
conflict_7	text(1)	level 7 (strategic nuclear war)
conflict_8	text(1)	level 8 (post-attack/reconstruction)
scenario 1	text(1)	n/w is to be operational in peace scenario
scenario 2	text(1)	operational in low intensity conflict scenario
scenario 3	text(1)	operational in conventional conflict-east scenarios
scenario 4	text(1)	operational in conventional conflict-west scenarios
scenario 5	text(1)	operational in conventional conflict-europe scenarios
scenario 6	text(1)	operational in theater nuclear scenarios
scenario 7	text(1)	operational in global nuclear scenarios
scenario 8	text(1)	operational during reconstruction scenarios
max-mean-xmit-time-obj	integer	objective max time allowable for a call to be received after transmission; <= 99999
max-mean-xmit-time-thrsh	integer	threshold max time allowable for a call to be received after transmission; this field is most critical in ITW&A networks
max-mean-xmit-time-crit	text(1)	maximum mean transmit time critical?; "y,n"
max-allow-access-time-obj	integer	objective max allowable access time to receive system access after a requirement; between 0 and 99999
max-allow-access-time-thrsh	integer	threshold max allowable access time to receive system access after a requirement; between 0 and 99999
max-allow-access-time-critical	text(1)	maximum allowable access time critical?; "y,n"
anti-spoof critical	text(1)	indicates if the anti-spoof capability of the network is critical?; "y,n"
global-reach/global-power mission	integer	AF global reach/global power functional mission areas; 1 - 7
net mission essential	integer	is network essential to the mission?; 1 - 3
net US control	text(1)	is entire satellite control sytem under U.S. control?; "y,n"
net access critical	text(1)	is the availability of the network critical?; "y,n"
command abbr	text(2)	abbreviation of the command name
milstar-loaded	text(1)	is requirement included in MILSTAR loading analysis?; "y,n"
primary mission	integer	three digit number describing the primary mission of the network
secondary mission-1	integer	three digit number describing the secondary mission of the network
secondary mission-2	integer	three digit number describing the tertiary mission of the network
last update	date	data of the last update of the network table

Table: Network-POC		
<u>network ID</u>	long integer	unique identifier of a network requirement
<u>POC ID</u>	long integer	unique identifier of a point of contact
Table: Network-Ref-Documnet		
<u>document ID</u>	long integer	unique identifier of a document
<u>network ID</u>	long integer	unique identifier of a network requirement
page number	text(15)	specific page number(s) in the document where the network information is located
Table: POC		
<u>poc id</u>	counter	unique number assigned to a point of contact (POC0
poc full name	text(30)	name of the point of contact (POC) for the network reqmt.
office symbol	text(12)	office code in mailing address of the poc
address	text(30)	first line of poc address
city	text(20)	city mailing address of poc
state	text(2)	two character state code for poc address
zip code	text(10)	mailing address ZIP code for poc
commercial phone	text(16)	commercial telephone number for the POC
dsn phone	text(10)	poc's phone number in the defense switch network
stu telephone number	text(16)	telephone number for the POC's stu phone
secure fax number	text(16)	telephone number for the POC's secure fax
unsecure fax	text(16)	telephone number for the POC's unclassified fax
Table: Terminal		
<u>terminal ID</u>	counter	terminal identification number
terminal nomenclature	text(50)	unique name or designator given to a terminal; indexed
user-ID	integer	number uniquely identifying a user; indexed
geo-ref-code	text(4)	unique identifier for each geographic location; indexed
serial number	text(10)	serial number of the terminal
region	text(2)	region code for this terminal location
reporting designator	text(50)	DISA assigned unique designator for DSCS terminals
activation date	mm/dd/yyyy	actual or projected activation date of the terminal
deactivation date	mm/dd/yyyy	actual or projected deactivation date of the terminal
remarks	text(50)	remarks regarding the characteristics or configuration of a terminal
Table: Terminal-Connect		
<u>connectivity ID</u>	long integer	unique identifier for a connectivity
<u>terminal ID</u>	long integer	unique identifier for a terminal

origin-destination-field	text(6)	identifies the terminal as either being a origin or destination terminal; "origin" or "dest"
Table: Terminal-Type		
nomenclature	text(15)	unique name of terminal
freq	text(3)	indicates the frequency band in which the terminal is designed to operate; "UHF, SHF, EHF, or UNK"
mobility	text(6)	indicates the mobility employed by the terminal; "Fixed, Mobile, or Trans"
platform	text(5)	indicates the specific type of platform employed by the terminal; "Ship, Sub, Air, Man, Truck, or Fixed"
antenna size	integer	indicates the diameter in feet of the antenna matched to the terminal
low eirp	double	low end of range of radiated power available from a terminal/antenna configuration; 0 - 999
high eirp	double	high end of range of radiated power available from a terminal/antenna configuration; 0 - 999
low gt	integer	low end of range of receive sensitivity available with a terminal/antenna configuration; 0 - 99
high gt	integer	high end of range of receive sensitivity available with a terminal/antenna configuration; 0 - 99
min data rate	double	indicates the minimum data rate (kbps) that the terminal is designed to allow; 0 - 9999.99
max data rate	double	indicates the maximum data rate (kbps) that the terminal is designed to allow; 0 - 9999.99
Table: User		
user id	integer	unique identifier of a user
user-name	text(15)	user (node) identifier of a connectivity
geo-ref-code	text(4)	unique geographic reference code of user; indexed
user-region	integer	geographic region where the user is located. Values 1 - 31.

(Source for many of these data elements: ARINC Research Corporation, Software User's Manual for the MILSATCOM Planning Support System, Version 5.2, June 1992)

APPENDIX B - MRDB QUERIES

This appendix provides a complete listing of all the queries used by this database. They are as follows:

CINCS-in-Alpha-Order
Comp-in-Alpha-Order
Comp-in-Alpha-Order-for-Network-Update-Form
Conn-and-Net-ID
Database Diagram
Detailed-Dest-Subrep-Query
Detailed-Doc-Subrep-Query
Detailed-Network-Rep-Query
Detailed-Orig-Subrep-Query
Detailed-POC-Subrep-Query
Doc-Title-and-ID
Geo-Loc-Codes
Net-Acronym-ID
Nets-by-Operational-Dates-Results
Networks-All-Satisfaction-Levels
Networks-by-All-CINC/Components
Networks-by-CINC-All-Components
Networks-by-CINC-and-Component
Networks-by-Satisfaction-Level

POC-Name-ID-List
Term-Nomenclature-and-ID
Term-Type-Term-Subform
Term-User-Dest-Subrep-Query
Term-User-Origin-Subrep-Query
Term-User-Query
Term-User-Subrep-Query
Terminal-Connectivity-Query
Terminal-Location-Info
Terminal-Type-Sorted
Terminal-User-Rep-Query
User-Location-Info
User-names-and-IDs
User-Term-Subform-Query
View-Conn
View-Doc
View-POC
View-Terminals

APPENDIX C - ISLOADED FUNCTION

Programming code for the IsLoaded function. Code is written in Microsoft Access Basic.

Function IsLoaded (MyFormName)

' Accepts: a form name

' Purpose: determines if a form is loaded;

' Returns: True if specified form is loaded;

False if the specified form is not loaded.

Dim i

IsLoaded = False

For i = 0 To Forms.Count - 1

 If Forms(i).FormName = MyFormName Then

 IsLoaded = True

 Exit Function ' Quit function once form has

 End If ' been found.

Next

End Function

(Source: Microsoft Corporation, *Microsoft Access Northwind Database Example*, 1992)

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3. Elmasri, R, and Navathe, S.B., *Fundamentals of Database Systems*, The Benjamin/Cummings Publishing Co., Inc., 1989.
4. Microsoft Corporation, *Microsoft Access Getting Started*, 1992.
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